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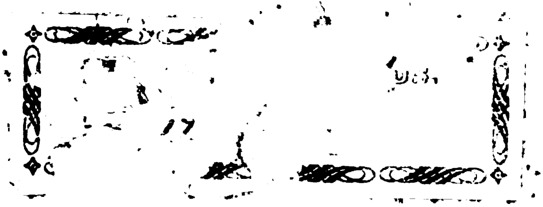

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ELEMENTS

OF

SURGERY

FOR

The Use of Students

WITH PLATES

BY

JOHN SYNG DORSEY, M.D.

PROFESSOR OF ANATOMY IN THE UNIVERSITY OF PENNSYLVANIA
ONE OF THE SURGEONS TO THE PENNSYLVANIA HOSPITAL
AND TO THE PHILADELPHIA ALMS HOUSE, &C.

IN TWO VOLUMES

SECOND EDITION WITH ADDITIONS.

VOL. I.

> for want of timely care
> Millions have died of medicable wounds.
>
> ARMSTRONG.

UNIVERSITY OF PENNSYLVANIA.

PHILADELPHIA

Published by E. & R. Parker & Benjamin Warner.

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PHILADELPHIA:
PUBLISHED BY EDWARD & RICHARD PARKER, No. 178, AND
BENJAMIN WARNER, No. 171, MARKET STREET.
JOSEPH R. A. SKERRETT, PRINTER.
....
1818.

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STUDENTS OF SURGERY

THROUGHOUT THE UNITED STATES,

THIS

IMPERFECT ATTEMPT

TO FACILITATE THEIR STUDIES

IS VERY RESPECTFULLY

INSCRIBED.

PREFACE.

NUMEROUS circumstances combine to render necessary an American Epitome of Practical Surgery; those members of the medical profession who, by talent and experience, are best qualified to compose it, are fully occupied by other duties, and indifferent to that species of reputation which might accrue from such a publication; the labour has therefore, in the present instance, devolved upon one in many respects inadequate to the performance, and fully sensible of the imperfections of his work.

An American, although he must labour under many disadvantages in the production of an elementary treatise, is in one respect better qualified for it than an European surgeon. He is,—at least he ought to be,—strictly impartial, and therefore adopts from all nations their respective improvements. Great Britain and France have been foremost in the cultivation of modern surgery, but their deficiency in philosophic courtesy and candour has in some instances greatly retarded its progress; to illustrate this remark, it will be sufficient to state that the doctrines of adhesion so ably developed in England have been shamefully neglected in France; and that French surgery

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ELEMENTS

OF

SURGERY.

CHAPTER I.

General Remarks on Accidental Injuries, and their Effects.

IT is the business of the surgeon to provide remedies for the various *accidents* to which the human body is liable; the treatment of many of its *diseases* is also committed to his care. As accidental injuries are more simple and intelligible than diseases, it will be proper to commence an elementary work on surgery with some general explanations of their nature and effects.

The most simple accident, which can possibly occur, appears to be that degree of concussion, " in which the only effect produced, is a debility of the actions or functions of a whole or part, similar to that occasioned by a bruise, in which the continuity of the substance *is not* interrupted; in such a state, the parts have little to do, but to expand and reinstate themselves in their natural position, actions, and feelings; and this is what happens in the concussion of the brain."

The rupture of a small blood-vessel is perhaps the next in order of simplicity; when the continuity of the part *is* broken, extravasation takes place, and the blood is effused into the common cellular membrane, into the interstices of some part, or into a circumscribed cavity.* But should the vessel be either very large, or essential to life, such as the femoral, bracheal, or coronary arteries; or should the rupture take place in a vital part, as the brain, in such cases the injury may kill from the extravasation alone, however inconsiderable may be the original mischief.

Another species of injury is that in which the ruptured parts have an external opening, constituting a wound. The nature and circumstances of wounds will be considered in another place. The operation of restoration in this case consists, first in the coagulation of the extravasated blood between the ruptured parts, laying as it were the foundation of union, next in closing the ruptured vessel, or in promoting its inosculation, and afterwards in bringing about an absorption of the superfluous coagulated blood. Whether in these cases a new portion of vessel is formed, or whether the original vessel re-unites without the intervention of a new cylinder is not easily determined.

This mode of restoration is called *union by the first intention;* it is evident that it can only happen in cases where the extent of the divided parts is small, and their surfaces nearly in contact. In this case, the blood effused by the accident is the bond of union, and it evidently becomes living flesh.

When the quantity of blood poured out is very great, even in parts not essential to life, considerable inconvenience results from the inability of the absorbents to remove it. An effusion of blood under the skin, or in the interstices of any part of the body, is called *Ecchymosis*, and in some cases calls for surgical treatment. As the subject will not be resumed, I shall state here the proper remedies. They are *rest, moderate pressure, and cold applications; as cold lead water, cold vinegar and water, &c.* by the use of these means the blood will generally be absorbed, during which process the skin, which had been of a dark purple colour, becomes blue, green, yellow, and assumes a variety of hues. The blood most frequently in Ecchymosis coagulates, but it sometimes remains fluid; and in this latter case, is apt to inflame and suppurate; to prevent which, a puncture should be made with a lancet into the cavity containing the blood, which must be emptied by gentle pressure. After which care should be taken to approximate the sides of the puncture, that they may speedily unite. If, notwithstanding these remedies, the parts inflame and suppurate, the case is to be treated like any other abscess. If, from this, or any other cause, union by the first intention is prevented, another mode of restoration is effected by means of inflammation.

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* Fractures of tendons, simple fractures of bones, and many other injuries, in which there is no external communication, are considered by Mr. Hunter as similar in nature to this accident.

CHAPTER II.

Of Inflammation.

A COMPLETE acquaintance with this subject is essential to every practitioner of surgery. In the following remarks I shall endeavour to describe its phenomena without attempting to investigate the theories which have been formed to explain them.

Inflammation generally commences with an increased sensibility of the part; *pain* is soon perceived, attended with *heat, redness*, and *tumefaction;* the pulsation of the arteries in the inflamed parts occasions a throbbing, which in some situations is very distressing to the patient, as when the inflammation is seated in one of the fingers. The pain is attributed by Mr. Hunter to a spasm of the vessel, analogous to cramp, tetanus, &c. The tumefaction is owing to the enlarged diameters of the vessels, and to the effusion of serum and coagulating lymph in their interstices. The heat of an inflamed part never transcends the heat of the animal at the source of circulation, though the sensation would lead to a contrary belief.*

Inflammation is divided by surgeons into healthy and diseased. By *healthy* is understood, that which has for its object the restoration of injured parts; by *diseased,* that in which some morbid peculiarity is superadded to the simple act of inflammation, as in erysipelas, carbuncle, &c.

The *remote causes* of healthy or phlegmonous inflammation, are various irritations of a mechanical or chemical nature; wounds, bruises, acrid substances, &c. Sometimes inflammation appears to arise as a consequence of febrile diseases, forming what has been called, *critical abscess*; and in other instances no evident cause can be assigned, these cases are very improperly considered spontaneous, as they have certainly a remote cause, although it be not obvious.

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* The heat and redness are probably owing to the increased rapidity of circulation; but in what particular manner is not clearly understood.

The *proximate cause* of inflammation has been a source of much theoretical discussion. Mr. Hunter considered it as an increased action of the blood-vessels, and this at the present time is a generally received opinion.*

A variety in the *exciting cause* seems to have no effect in varying the nature of healthy inflammation; though different circumstances of the constitution or part, affect its progress very materially. Strength of constitution; a vigorous circulation of the blood; and vicinity to the source of circulation, are circumstances highly favourable to its progress, and under opposite circumstances, inflammation frequently terminates unfavourably. The legs, when inflamed, heal much less readily than the superior parts of the body. The colour also of an inflamed part, depends on similar circumstances. An inflamed leg is darker than an inflamed arm. When seated in very vascular parts, as skin, cellular membrane, muscle,—it is more rapid in its progress and more favourable in its termination, than in those which are less so; as bone, tendon, or ligament. As an exception to this remark, however, we must state, that when inflammation attacks vital parts, notwithstanding their great vascularity, it does not proceed so favourably as in those of a similar structure, which are less essential to life.

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* On this subject see Hunter on the blood, &c. and also Dr. Wilson's Essays on Febrile Diseases, in which the doctrines of Mr. Hunter are ingeniously, though I think, unsuccessfully opposed. Mr. John Pearson, with his usual accuracy, remarks, "by *proximate cause* is to be understood a real physical cause, so inseparably connected with the disease, that the presence of the one implies the agency of the other: upon the existence and duration of the proximate cause, depends the existence and duration of the disease; and if the former be changed, there is a correspondent change in the latter." This is precisely what Dr. Rush means when he declares, in the language of Gaubius, the proximate cause of a disease to be "ipse morbus." That mere increased action is not the proximate cause of inflammation, can easily be proved. Now since the action of inflammation is altered from healthy action, and since we cannot tell in what this alteration consists, it appears to me best to confess, that in the present state of our knowledge, the proximate cause of inflammation is not distinctly known. The degree of action in inflammation varies very greatly; sometimes it is feeble, and sometimes violent. The nature of the altered action of vessels in inflammation, is not more likely to be discovered, than the nature of those actions which in the liver form bile, in the kidneys urine, &c. The mere alternate contraction and dilatation of blood-vessels offer no explanation on any of these subjects.

Healthy inflammation is always greatest at the part nearest the external surface of the body. When it attacks the socket of a tooth, it affects the external part next the cheek; when it occurs in the vicinity of the rectum, it affects the skin and cellular texture, leaving the intestine sound.

The effects of local inflammations upon the constitution, depend much on their extent and situation. Where they are small, very little inconvenience results; where they are extensive, or seated in vital parts, greater irritation, and considerable fever, are the consequences. Inflammation occurring under a tendinous fascia, produces more effect on the constitution than the same degree of inflammatory action in other parts. The fever produced is called symptomatic, and is generally attended with a quick tense, full pulse, and sizy blood.

Healthy inflammation is always attended by one or more of the following effects—an adhesion of the inflamed parts, one to another; the formation of pus, and the removal of portions of the body by the absorbent vessels. The uniform occurrence of these effects induced Mr. John Hunter to describe inflammation in three different stages; the *adhesive*, *suppurative*, and *ulcerative*. The various parts of the body differ in their susceptibility of adhesion, suppuration, and ulceration. The cellular membrane; the circumscribed cavities, as the abdomen, thorax, tunica vaginalis, very readily form adhesions;—Mucous membranes, on the contrary, as the nose, mouth, alimentary canal, the air cells of the lungs, the trachea, &c. very seldom adhere, but readily suppurate. It is generally found that deep-seated parts suppurate less readily than superficial: hence, if a musket-ball be lodged at any considerable depth in the body, it excites adhesive inflammation, and a cyst forms round it; but if it be lodged nearer the surface, it produces suppuration, an abscess forms, and it is discharged.

The symptoms of inflammation which have been described, exist very evidently in the adhesive stage, but when suppuration is about to commence, they are greatly aggravated; the pain and throbbing become more violent, the heat is augmented, the swelling is more prominent, the colour more intense, and approaching to a pale scarlet. Shivering fits come on, the swelling grows softer, and matter is formed, fluctuation may be perceived by examination with the fingers: an immediate abatement of the symptoms now takes place.

If the inflammation be seated in the cellular membrane, the process of ulceration now commences, and the absorbent vessels remove the solid parts of the body to make room for the lodgment of the pus secreted, and also to prepare a way for its escape. In this manner an *Abscess* is formed, which may be defined a circumscribed cavity, containing pus. In a common phlegmonous abscess, we have a good example of the three effects of inflammation which have been briefly noticed. At its margin, where the inflammation is least violent, the inflamed vessels secrete coagulating lymph, which agglutinates and firmly unites the cells of the cellular texture, circumscribing the cavity, and preventing the escape of the matter into the surrounding parts. Towards the centre of the abscess inflammation has transcended the adhesive stage, and the blood-vessels have relieved themselves by a secretion of pus. This process immediately excites the action of the absorbing vessels, which remove the solid matter to form a cavity to contain this pus.

The natural cure of an abscess consists in the absorption of all the solid matter intervening between the pus and the cuticle, by the rupture or bursting of which, an outlet is made for the evacuation of the cavity, after which small projecting vascular spots appear, in every part of it, called granulations, which are formed of the coagulating lymph of the blood, which fill up gradually the cavity, and unite one with another, forming solid flesh—a formation of cuticle takes place on the surface, and thus the parts are restored nearly to their pristine state.*

The terminations of inflammation are various. In some instances it terminates by what is called *resolution*. In this case all the symptoms gradually subside, and the parts are restored to their natural colour and appearance.

The *secretion of pus*, already noticed, is to be considered one of the terminations of inflammation. A *secretion of serum* frequently puts a stop to the inflammatory process. The inflammation from cantharides terminates in this way. Instances of this we see also in inflammation in the brain, ending in hydrocephalus. In the thorax, terminating in hydrothorax, &c.

Hemorrhagy has occurred in some cases, and put an immediate stop to inflammation.

Hard tumours occasionally form by the secretion of coagulating lymph in the interstices of parts, and this has been called a termination of inflammation in *scirrhus*.

In other instances the violence of action or the kind of action exhausts the vital powers of the inflamed part, and the inflammation terminates in *mortification*.

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* For a particular account of the process by which cavities are filled up, I refer to Mr. Hunter, and a paper by Mr. James Moore.

TREATMENT OF INFLAMMATION.

In the treatment of inflammation the first object is, to remove if possible the remote causes, if they continue to act. The next is to lessen the inflammatory action. The remedies to effect this latter object are *general,* or *constitutional,* and *local.* Those which act on the constitution are,

1st. BLOOD-LETTING. This is a powerful remedy in the treatment of inflammation. The quantity of blood to be drawn, and the frequency of its repetition, can only be estimated by the violence of the inflammatory symptoms. Whenever parts essential to life are inflamed, as the brain, or the contents of the thorax, or abdomen, repeated and copious bleedings become necessary.

2d. LOW DIET—Tends not only to diminish the fullness of the vessels, but also to lessen irritation, and should be strictly enjoined.

3d. PURGING is often necessary in the treatment of inflammation. But in many cases it is inconvenient on account of the necessity which it occasions for moving the patient, as in cases of fractured bones. Blood-letting must therefore be substituted.

4th. Certain NEUTRAL SALTS—Sulphate of Soda, Sulphate of Magnesia, Nitrate of Potash, &c. are useful, by promoting the secretions, and are generally combined with preparations of antimony; in which case they occasion nausea, and diminsh the action of the blood-vessels.

5th. REST is essential, for motion occasions irritation and many inflammatory affections are found difficult of cure, because the inflamed parts cannot be kept at rest; fistula in ano affords an illustration of this remark.

6th. Position. The posture of the body should be such as to favour the return of blood from the inflamed part. In many local inflammations, posture is of extreme importance. The elevation of the feet in cases of inflammation on the lower extremities, is found highly useful. It forms indeed one of the methods of depleting by emptying the blood vessels of the affected part.

7th. Opium may be given to relieve pain in some cases.

The local remedies, are, 1st. *Bleeding* from the inflamed part by cupping, leeches, and scarifications. Local blood-letting is most effectual after general bleeding has been premised.

2d. Cold Applications are sometimes of service, but they should only be carried so far as to be pleasant to the feelings of the patient. A very common application which is intended to reduce the temperature of inflamed parts, is a solution of sugar of lead, with or without the addition of vinegar. ℈j of acetate of lead, to ℥iv of water, answers the purpose as well as any other preparation. It is to be applied on linen rags; and, as it soon acquires the temperature of the part, these rags should be often changed.

3d. Blisters are, in certain cases, of great use in diminishing inflammation. They must be applied directly over the inflamed part; and in many cases, produce a speedy cure.

All these remedies tend, by diminishing the violence of inflammation in its adhesive stage, to prevent suppuration, which is generally to be attempted: but cases occur in which this event is desirable, and others in which it is inevitable. The best application in such cases is a soft poultice of bread and milk, with the addition of a little sweet oil, or fresh lard; or ground linseed and water.

When suppuration has taken place, and a fluctuation of matter can be perceived, if it be not soon evacuated by absorption, it becomes necessary to expedite the cure by an artificial opening.

Abscesses should be opened early, when situated near the larger cavities of the body, as the thorax or abdomen, instances having occurred in which they have discharged their contents into these cavities, occasioning fatal consequences. In paronychia, or other very painful collections of matter, especially where the pus is confined under a tendinous fascia, an early opening should be made;—when situated near large joints;—when they impede respiration or deglutition;—when they occasion nervous fever, or other constitutional affections, they should be opened early. The best application after the cavity of an abscess is evacuated is a soft linseed or bread and milk poultice.*

There are two ways of opening abscesses; by incision or puncture, and caustic. The lancet is to be preferred whenever we can choose; if the patient, however, from great fear of a cutting instrument obstinately refuses to submit, caustic may be substituted—a piece of caustic vegetable alkali rubbed over the part eight or ten minutes, will occasion a slough, and give vent to the pus.

The properties of pus have been well described by Mr. Home. It is a light straw-coloured fluid of the consistence of cream, composed of globules swimming in a fluid, which fluid is coagulable by muriate of ammonia—a property which distinguishes pus from all other animal fluids. Healthy pus is perfectly bland, free from all acrimony. It is heavier than water, and sinks in it without mixing. Pure pus does not readily putrefy; but when mixed with blood or extraneous matter it ferments and becomes putrid, acquiring a fetid smell, and is now acrid and irritating. It is evidently a secreted fluid poured out by the inflamed vessels which assume the nature of a gland.

---

* A very ready mode of preparing the linseed poultice, is to mix the linseed meal with warm water until it acquires a proper consistence. If the linseed meal be not at hand, it is easily prepared by passing common flax seed through a coffee-mill.

CHAPTER III.

Of Hectic Fever.

FEVER results from every extensive local inflammation. This fever is called symptomatic, but if the local disease continue for a great length of time, and until the system is weakened, febrile symptoms of a very different character ensue and constitute what is called *hectic fever*.

The symptoms of hectic, are, great weakness; a frequent small pulse, a moist skin, copious flow of urine, moist tongue, loss of appetite, nausea, occasional vomiting, night sweats, diarrhœa, frequent chills succeeded by flushes of heat; watchfulness to a distressing degree, and flatulency together with the several symptoms of indigestion.

Hectic fever has been ascribed by Dr. Cullen and many others to the absorption of pus. This opinion is however without foundation, and many facts concur to prove that copious absorption of matter may take place without hectic fever, and many cases of hectic fever occur unattended by an absorption of pus. Of the former we have examples in the absorption of matter from buboes and other abscesses, which are not followed by symptoms of hectic, and of the latter we have instances in those cases of scrofulous joints in which hectic fever precedes suppuration, an occurrence by no means unusual.

The cure of hectic fever will in vain be attempted, whilst the local disease which gives rise to it continues. If the local inflammation be absolutely incurable, and in such a situation as to admit removal by a surgical operation, this ought always to be done. The effects of removing even a small local irritation, are in some instances truly astonishing. Patients apparently on the brink of the grave, become convalescent in a few hours.

If however the part can neither be cured nor removed, the strength of the patient must be supported by an invigorating diet and tonic remedies. The Peruvian bark and opium are here valuable medicines, and must be administered according to the exigency of the case.

CHAPTER IV.

Erysipelatous Inflammation.

This has been considered a disease of the cutis vera; it differs from healthy inflammation in many circumstances. It commences at a particular spot and very rapidly extends itself, sometimes over a large portion of the body. In some cases it is preceded by a chill and general fever, in other cases the local affection is first observed.

The colour of the skin when affected with erysipelas is a bright scarlet. There is less tumefaction than in phlegmon, but yet some elevation of the inflamed part, and a decided line of distinction where it terminates. Pressure on the skin causes the redness to disappear, but on removing it, the colour quickly returns. The pain differs from that of phlegmonous inflammation; it is of a burning kind and attended in many instances with intolerable itching, especially when seated on the nates and perineum. When it occurs in the face, it is attended with greater tumefaction than in any other part, and is more dangerous. The cellular membrane around the eyes are much swollen and appear as if distended with a fluid having a semi-pellucid appearance. In some cases it is attended with vesications, which contain a fluid somewhat acrid, when these burst, scabs are formed and a sore beneath them.

In erysipelas there is never a secretion of coagulating lymph. It either terminates in resolution, or in a kind of suppuration, or else in gangrene. When suppuration takes place, as there is no secretion of coagulating lymph to circumscribe the abscess, the pus travels through the cells of the cellular membrane, occasioning violent inflammation and gangrene, the parts slough out, and have a very strong resemblance to wet tow. I have seen death occasioned in such a case by the very extensive diffusion of the matter through the cellular texture producing mortification wherever it went.

Where the affection is limited in extent and moderate in degree, it generally gets well in a week or ten days, the skin casting off its cuticle in small flakes like bran.

The constitutional symptoms are in many cases very severe, great debility, head-ache, nausea, vomiting followed by violent fever and delirium.

The remote causes of erysipelas cannot be distinguished from those of common inflammation. The state of constitution, appears to influence them in producing phlegmon in some cases and erysipelas in others.

TREATMENT.

The remedies are the same as for common inflammation. Bleeding is generally indicated; purging—low diet—neutral salts and antimonials, are to be administered according to the exigency of the case. In London, bark and tonics are very frequently exhibited with advantage, but an opposite plan of treatment is required in America. As a local application, rye meal or wheat flour is found pleasant and useful; poultices and all unctuous substances do mischief. Cold lotions are sometimes used with advantage; a solution of acetate of lead is the best. Blisters are a remedy of great efficacy; in some instances they occasion an immediate cessation of the disease. The late Dr. Pfeiffer, of this city was in the habit of employing them for many years with advantage in cases of erysipelas. When suppuration takes place large openings must be made for the evacuation of the pus and sloughs.

CHAPTER V.

Of Œdematous Inflammation.

THE following remarks of Mr. Hunter contain a very accurate account of this affection. "What I would call the œdematous inflammation is, when the extravasated fluid is water. It has very much the appearance of the adhesive, and comes probably the nearest to it of any, being of a scarlet colour, but much more diffused. The fluid extravasated, being principally the serum, renders the swelling more diffused than even the inflammation itself. It is very painful, or rather sore, but there is not so much of the throbbing sensation as in the adhesive inflammation; it appears to be only the surface, but most probably goes much deeper: for in such cases the extravasated fluid is in too large quantity to be furnished by the cells of the cutis alone, but in this we have not the same guide as in the adhesive, namely, the swelling and inflammation corresponding with each other.

"The difference between this inflammation and the adhesive arises, I conceive, from the principle of inflammation acting upon a dropsical disposition, which is always attended with weakness, whereas a greater degree of strength would have produced the adhesive inflammation under the same cause or irritation, and what makes me conceive this is, that in many cases of anasarcous legs we have exactly this inflammation, come on from distention, which adds to the extravasation of the serum, as well as in most cases of scarifications of œdematous parts to evacuate the water. When inflammation takes place it is much more lasting than the adhesive, and, I believe, seldom or ever produces suppuration; but if it should run into this stage it is more general, and the whole cellular membrane, in the interstices of parts, is apt to mortify and slough, producing very extensive abscesses, which are not circumscribed."

The remedies before the secretion of water takes place, are the same as for common inflammation. We shall add a few words on this subject in the chapter on ulcers.

CHAPTER VI.

Of Gangrene and Mortification.

MORTIFICATION is the entire death of a part of the body, gangrene is that state or condition which immediately precedes it. It is gangrenous so long as it retains sensibility, motion, and warmth, when these cease and it acquires a livid, brown, or black colour, it is mortified, or in a state of sphacelus.

Mortification is of two kinds: the one is not preceded by inflammation, the other is.

I. Mortification, not preceded by inflammation, may be occasioned by a variety of circumstances. Interruptions to the circulation of the blood, as the application of a ligature to the arterial trunk supplying the part, or pressure on the large veins by which the return of blood is prevented, as in strangulated hernia. Continued pressure on a part of the body, occasions mortification: this is seen in the hips and backs of patients who have been long confined to one posture in bed. Disorganization by external violence, intense heat or cold, also produce mortification which is not preceded by inflammation. When mortification from any of these causes commences, the parts become livid, cold, purple, black, lose all sensibility, become covered with vesications, containing a bloody dark serum, and at length putrefy, and emit a fœtid smell.* These cases admit of no remedy. A soft bread and milk poultice is to be applied to prevent the dead parts from becoming hard and dry, and thereby adding to the irritation. If the part mortified be very extensive, the constitution sinks, and death takes place. The use of tonics and stimulant medicines, are necessary in these cases. Peruvian bark, elixir of vitriol, and opium, are among the most useful.

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* The process of "sloughing," in surgical language, signifies the separation of dead and living parts.

When a part has been exposed to intense cold, the greatest care should be taken to raise its temperature gradually, as it is found invariably to mortify when heat is suddenly applied. It should first be placed in ice or snow, afterwards in cold water, and very gradually warmed.

In some rare instances, mortification comes on without any evident cause, except extreme debility. I have known an instance of this after a severe attack of yellow fever. This is, probably, not preceded by inflammation.

II. Mortification in many instances is preceded by inflammation. 1. It may arise from the violence of the inflammatory action exhausting the vital powers of the part; or, 2dly, from some peculiarity in the nature of the inflammation.

1. "Inflammation is an increased action of that power which a part naturally possesses, and in healthy inflammations at least, it is probably attended with an increase of power. In cases however which are to terminate in mortification, there is no increase of power, but on the contrary a diminution of it. This when joined to an increased action, becomes a cause of mortification, by destroying the balance which ought to subsist between the power and action of every part." (*Hunter.*)

When inflammation has, either not been properly treated, or has resisted the remedies usually successful, and is about to terminate in mortification, the pain and fever suddenly ceases, the heat is diminished, the red colour is changed to a dark purple, and the swelling which was tense and hard, becomes softer. The cuticle is elevated in various places and vesications form, filled with a darkish and sometimes a transparent fluid. This gangrenous condition rapidly progresses to a complete mortification, attended with putrefaction.

The constitutional remedies for it are all such as by lessening inflammatory action, have a tendency to produce resolution or suppuration. These have been already mentioned in the chapter on inflammation. Wherever the violence of the symptoms lead to an apprehension of gangrene, the evacuations by bleeding, purging, &c. are to be increased, and carried as far as the state of the system will warrant.

The indiscriminate use of evacuating remedies, is however by no means proper. The sudden diminution of strength which frequently precedes mortification, demands a very opposite mode of treatment, and here tonic remedies are strongly indicated. Wherever the inflammatory action suddenly subsides, and with it the symptomatic fever, and a great diminution of vigour is perceived in the patient's constitution, the use of tonics and a generous diet, with fermented liquors, especially wine, are to be directed. These remedies have no effect certainly on parts already mortified, but they fortify those which are not, and thereby prevent the progress of the gangrene.

The Peruvian bark has long been celebrated for its virtues in this particular case. It is a valuable tonic, but has probably no specific virtues, and has done great mischief when administered during an inflammatory state of the system. The encomiums lavished on it at the beginning of the last century, appear to have been extravagant, and surgeons no longer recommend its indiscriminate exhibition in cases of gangrene. When the stomach rejects it in substance, it may be administered in decoction, but it often produces so much nausea, that its exhibition is necessarily precluded.

The local remedies which have been used in cases of mortification, are various. In the first place, if there exist any local irritation which has a tendency to keep up the inflammatory action, and thus extend the mischief, these are to be removed. The application of cataplasms and poultices can have no effect on the mortified parts except by keeping them moist, or correcting the fœtor which exhales, but these are important objects and should not be neglected. A poultice of bread and milk mixed with laudanum; of linseed, or of scraped carrots well boiled in milk answers in general every purpose, and if renewed once in three or four hours keeps the parts sufficiently clean, but in warm weather when the smell is very fœtid, the addition of finely powdered charcoal to the poultice of linseed, ℥ij. to the pound, has some effect in rendering it more tolerable. A poultice consisting of oatmeal and beer, stirred together until they have a proper consistence, is much used by surgeons with a similar intention. The fermenting cataplasm, with or without the addition of charcoal, is also a useful application. It is made in several ways; the easiest and therefore the best, is by mixing equal parts of yeast, flour and honey —if requisite, powdered charcoal may be added.

Certain stimulating applications have been much used; the various balsams, resins, aromatics, alkohol, &c. They are in general laid aside. The temperature of the local applications should be attended to; if they be applied too hot, they increase inflammation, and if too cold, they weaken the parts. The temperature should be nearly that of the part to which they are applied, and they must always be light, so as not to offend by pressure.

Scarifications, if ever, are very rarely necessary. There can be however no doubt of the propriety of making punctures through mortified parts whenever there is confined acrid matter beneath them, irritating the living parts; they should never extend into sound flesh. In cases of gangrene from erysipelas, this practice is particularly necessary. Wherever extensive sloughing of the cellular membrane from any other cause, as extravasated urine, &c. takes place, they are equally proper, but they should never be used with a view to expose the sound parts, in order to apply local remedies to these. When performed with this view, they occasion great pain and inflammation, and must therefore add to the danger and spread the mortification.

The knife should not in general be used with a view to separate the dead from the living parts; this separation will be readily effected by a natural process instituted by the absorbent vessels, and to them it should be committed.

When gangrene is situated in one of the extremities, it has been the practice of some surgeons to amputate the member. The dangers attending this practice, and the fatal result of a great number of cases, have induced modern surgeons to lay it aside.

When the limb is completely mortified and putrid, and the absorbents have begun to separate the dead from the living parts, portions of the putrid flesh may be cut off to diminish the smell, but this should be done with great care, so as in no instance to injure the living parts. After the whole of the soft parts are separated by the absorbents, the bones may be sawed through; but it commonly happens that the bone has mortified higher than the flesh, and therefore, the same process of separation by the absorbents must be waited for, so that the only advantage arising from the operation is a removal of the inconvenience of a putrid and offensive mass, the cure not being at all expedited by the operation.

I shall conclude this account of the local treatment of mortification consequent to inflammation, by recommending in every instance the application of a blister, large enough to cover all the sound parts in contact with the diseased. This remedy was introduced into practice by Dr. Physick, who was led to apply it from the success of blisters in cases of erysipelas. He first employed it in January 1808, and from that time until the present, has had the greatest reason to be pleased with its effects. A great number of cases have occurred in various parts of the United States, in which an immediate cessation of the progress of the gangrene has been the result of its application. I have witnessed its effects in a variety of instances, and have no hesitation in recommending it, in preference to all other local remedies. After the first dressing of the blister, it will generally be found that the mortification has ceased to progress, and in a very short time the separation of the sloughs commences.

2. Mortification it was observed appears in some cases to arise from something peculiar in the nature of the inflammation which precedes it, independently of its apparent violence. The pustule of small-pox and carbuncle are specimens of this.

The inflammation of the small-pox pustule terminates by occasioning the death of that portion of cutis vera in which the inflammation was situated.

CARBUNCLE. This is a tumour beginning on different parts of the body, most frequently on the back; the pain attending it is very great, and of a burning kind; the skin itches, and under it is found a very hard circumscribed tumour, which becomes of a dark red colour. A kind of imperfect suppuration takes place under the skin, attended with gangrene of the cellular membrane, and skin; sloughs form, and several openings are thus made into the cavity of the tumour, which discharges a fetid pus.

The size of these tumours varies greatly, in some instances, they are small, in others many inches in diameter—I have seen them extending quite across the back. In general they occur in advanced life, and in those who have lived well. When they are very large they often terminate fatally; in those instances where several occur at once, they are also fatal. Carbuncle occasionally forms on the head, or high on the neck, and these cases generally terminate unfavourably when they are large. In sound constitutions and in patients not very far advanced in life, a cure may commonly be expected.

The cure depends greatly upon the state of the constitution, and this must influence our prescriptions: in general great debility attends, and demands a cordial invigorating diet. Opium must be given to relieve pain, and the bark and elixir of vitriol may often be used with advantage.

As a local remedy, the application of a blister is to be preferred to all others; I have known it produce immediate relief of the distressing burning sensation which invariably attends this complaint, and occasion a speedy separation of the sloughs. As soon as matter fluctuates under the skin, an incision must be made to discharge it, and a free passage is to be kept open for the evacuation of pus and sloughs. A plaster of common basilicon after the blister has been cut is to be applied, and if poultices are used, they should be very light and frequently changed.

Besides the cases of mortification which have been described, there is a species of mortification which takes place in the toes and feet of old persons, whether or not it is preceded by inflammation is undetermined; Mr. Hunter thinks it is.

The following account of this singular affection is taken from the writings of Mr. Pott.

"It is very unlike to the mortification from inflammation, to that from external cold, from ligature, or bandage, or to that which proceeds from any known and visible cause, and this as well in its attack as in its progress. In some few instances, it makes its appearance with little or no pain; but in by much the majority of these cases, the patients feel great uneasiness through the whole foot and joint of the ankle, particularly in the night, even before these parts show any mark of distemper, or before there is any other than a small discoloured spot on the end of one of the little toes.

It generally makes its first appearance on the inside, or at the extremity of one of the smaller toes, by a small black, or bluish spot: from this spot the cuticle is always found to be detached, and the skin under it to be of a dark red colour.

If the patient has lately cut his nails, or corn; it is most frequently, though very unjustly set to the account of such operation.

Its progress in different subjects and under different circumstances, is different; in some it is slow and long in passing from toe to toe, and from thence to the foot and ankle; in others its progress is rapid and horribly painful: it generally begins on the inside of each small toe, before it is visible either on its under or upper part, and when it makes its attack on the foot, the upper part of it first shows its distempered state, by tumefaction, change of colour, and sometimes by vesication, but wherever it is, one of the first marks of it is a separation or detachment of the cuticle.

Each sex is liable to it; but for one female in whom I have met with it, I think I may say, that I have seen it in at least twenty males. I think also that I have much more often found it in the rich and voluptuous, than in the labouring poor: more frequently in great eaters, than free drinkers. It frequently happens to persons advanced in life, but it is by no means peculiar to old age. It is not, in general, preceded or accompanied by apparent distemperature either of the part, or of the habit. I do not know any particular kind of constitution which is more liable to it than another; but as far as my observation goes, I think that I have most frequently observed it to attack those, who have been subject to flying uncertain pains in their feet, which they have called gouts, and but seldom in those who have been accustomed to have the gout regularly and fairly. It has, by some been supposed to arise from an ossification of vessels; but for this opinion I never could find any foundation but mere conjecture.

The common method of treating this distemper is, by spirituous fomentations, cataplasms actually and potentially warm, by dressings of the digestive kind, as they are called, animated with warm, pungent oil and balsams, &c. and, internally, by the Peruvian bark.

I wish I could say that this, which, with little alteration, has been the general practice, had been most frequently successful; but I am, from long and repeated experience, obliged to say that it has not.

I am sensible, that many of my readers will be surprised at my affirming, that the Peruvian bark will not stop a mortification, a distemper in which for some years, it has been regarded as specific; but I must beg not to be misunderstood; I mean to confine my observation and my objection to this particular species of mortification, which I regard as being sui generis: and under this restriction I must repeat, that I have seldom, if ever seen the bark successful: in all other cases, wherein it is used or recommended, no man has a higher opinion of it; but in this I cannot give it a praise which it does not deserve.

"I believe I may venture to say, that I have tried it as fairly, as fully, and as variously as any man has or can: I have given it in the largest quantities, at the shortest intervals, and for the longest possible space; that is, as long as the patients life would permit. I have given it by itself in decoction, extract, and substance: I have combined all these together: I have joined it with nitre, sal. absynth. with snake-root, with confect. cardiac. with volatile salts, and with musk, as different circumstances seemed to require, or admit: I have used it as fomentation, as poultice, as dressing: I have assisted it with every thing which has been usually thought capable of procuring, or assisting digestion; still the distemper has continued its course, perhaps a little more slowly, but still it has ended in death.

"I am sorry to rob one of our great medicines of any part of its supposed merit, but as on the one hand, its claim, in this instance, is unjust, and as on the other, I hope to add as much to the character of another, the res medica will be no sufferer.

"Some time ago, I had a patient labouring under this complaint, who from antipathy, obstinacy, or some other cause, could not be prevailed on to take bark in any form whatever. I made use of every argument but to no purpose: fomentation, poultice, and the usual dressings were applied in the usual manner; the disease advanced some days more, some days less, and at the end of a fortnight, the small toes were all completely mortified; the great one became blackish, the foot much swollen, altered in colour, and the disease seeming to advance with such hasty strides, that I supposed a very few days would determine the event. The pain in the foot and ankle was so great, and so continual, as totally to deprive the patient of sleep. On this account, and merely to procure some remission, I gave two grains of opium at night, which not having the desired effect, I repeated it in the morning. Finding, during the following day, some advantage, I repeated the same dose night and

morning, for three days; at th oma frequently attend.
patient became quite easy, and th life, generally termi-
foot and ankle were visibly more favour sion
by this, I increased the quantity of the me s are
one grain every three or four hours, taking ca nma-
its narcotic effect, and to keep the belly empty b
ters. In nine days from the first administration of ich
opium, all the tumefaction of the foot and ankle totally subsided, the skin recovered its natural colour, and all the mortified parts plainly began to separate; in another week they were all loose, and casting off, the matter was good, and the incarnation florid. During the whole of this time I continued the use of the opium, varying its quantity as circumstances required, but never gave less than three or four grains in twenty-four hours.

"When the sloughs were all cast off, the bones separated, and I had only a clean sore to dress and heal, I gradually left off the medicine.

"To relate cases which are nearly, or at least materially similar, is of no use: I shall therefore only say, that every opportunity, which I have had since of making the experiment, has still more and more convinced me of the value and utility of this medicine, and of its power of rescuing from destruction, persons under this affliction.

"I cannot say that it has never failed me: it certainly has; but then it has been under such circumstances, as I think would fairly account for the failure."

In addition to Mr. Potts' account of this species of mortification, I shall just add, that in the only case of it I have ever seen, the application of a blister produced an immediate termination of the mortification.

CHAPTER VII.

Of Burns.

THE application of excessive heat to the body, occasions severe pain, and inflammation. Its consequences are more or less serious in proportion to the degree of heat applied and the time of its continuance.

When the degree of heat is not very great it produces pain, redness and slight inflammation which subsides spontaneously when the heat is removed. A greater degree of heat occasions more severe pain; vesications form filled with serum and the true skin under these vesicles, is much inflamed. If the burn be extensive, fever attends and suppuration takes place. If the heat be still more intense, the life of the part is destroyed.

As a general remark it may be stated that burns are dangerous in proportion to their extent. A burn which destroys the life of a small part of the body, will produce but little effect on the constitution, whilst an extensive burn, even if very slight in degree, will occasion death. I once saw a child scalded on the back, from the neck to the hips, by falling into a tub of water in which her mother was washing clothes; the heat occasioned a few vesications, but the inflammation appeared slight, and yet on the fifth day the child expired.

When the heat is so intense as to destroy the life of the part, less pain is experienced than in light burns, but when the eschar begins to be separated by the absorbents the pain is augmented; very little pain appears to be suffered by those who are scalded, and die a few hours after the accident. In one such instance, I have known the patient to complain of nothing but extreme coldness. In these cases, drowsiness and coma frequently attend. Burns which affect parts essential to life, generally terminate unfavourably. Burns on the head often occasion death, by affecting the brain. When the larger joints are burned, there is great danger from the violent inflammation which follows.

TREATMENT. There is no branch of surgery on which a greater diversity of opinion and of practice exists than in the treatment of burns; remedies apparently opposite in their nature succeed in the hands of different practitioners, and whilst one surgeon strenuously recommends the use of ice and cold water, another proposes an application of hot spirit of turpentine.

A late writer on this subject, Mr. Kentish, who has had very extensive opportunities of applying his principles, declares that the stimulating plan of treatment is most successful, and he advises the constitution to be stimulated with opium and ardent spirits, and the part affected to be dressed with a liniment composed of spirits of turpentine and basilicon. The theories which have led Mr. Kentish to this practice, are by no means satisfactory, though the local application he has recommended is extremely valuable.

The method which is found to succeed best by the surgeons of this country, is to attend as in all other cases to the state of the constitution, and to accommodate the general remedies to it. If there be great pain, opium is to be administered. If considerable fever arise, bloodletting and evacuating means are to be used. If on the contrary, weakness and want of action appear to require them, stimulating remedies must be resorted to.

As a local application to a burn I have found nothing so generally successful as the ointment recommended by Mr. Kentish. The common basilicon thinned by being mixed with the oil of turpentine, forms a liniment, which when spread on rags and applied to the burned surface, occasions great relief from pain, and hastens the formation of new parts. Mr. Kentish premises to this dressing, a lotion with brandy, or hot oil of turpentine, or hot alkohol. This is in general unnecessary, and the liniment may be applied without delay, and at any period within a few days after the accident.

It is not to be denied that cases occur in which this application so generally successful produces pain and increases inflammation. In some instances, however, this has arisen from a want of caution in the application. The surgeon, or his nurse, has been careless enough to apply the stimulating ointment to the sound skin, where it inevitably occasions much inflammation and pain. To obviate this inconvenience the plasters should be cut into small portions and applied to the burned surface only.

If, notwithstanding this caution, the liniment excites pain and inflammation, it must be removed and another application substituted. A great variety have been used. Vinegar in many cases affords great relief; lime-water mixed with oil is a very soothing application; scraped potatoes, a linseed poultice, lead water, are all useful in different instances, and if one should not afford relief, the others may be tried.*

The ulcers left by burns have some peculiarities. They shoot out fungous gradulations which do not readily cicatrize, and when these ulcers do heal, they contract so much, as in many cases to occasion great distortions.

To arrest the growth of fungus, prepared chalk should be sprinkled over the sore, and if this be not sufficiently powerful, burnt alum, or the common escharotic applications may be used.

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* Ice has been strongly recommended by Sir James Earl; it alleviates pain and may be applied in bladders over the other dressings.

To prevent deformity from the union of parts which ought not to adhere, we should be extremely cautious whilst the sores are healing, to interpose plasters between them, and by applying splints and bandages to preserve them in a proper posture. From neglect of this caution great mischief has often arisen. I have seen the chin of a boy adhering firmly to his breast; by which his mouth was kept constantly open, and his whole appearance was greatly deformed. The fingers when severely burned, are particularly apt to adhere together. When this unfortunately happens, we must cautiously dissect them loose, and prevent their re-union by proper dressings.

CHAPTER VIII.

The Effects of Cold.

The power of resisting the effects of cold by preserving a temperature nearly similar in all changes of the atmosphere, is one of the characteristics of living matter.

The human body possesses this power in a very great degree, and like all its other faculties, it is augmented by habit. The inhabitants of northern countries are subjected occasionally to degrees of cold which would unquestionably destroy the natives of the torrid zone. The degree of cold which may be endured without loss of life, cannot in the human subject be ascertained.*

In hospital practice and among the poor, the surgeon frequently finds toes and fingers, feet and hands, sloughing off in consequence of exposure to cold. He is not often called until it is too late to prevent this effect. When he is, the great object is to restore the warmth of the parts very gradually. A limb has been frozen perfectly stiff, and by being rubbed in snow, afterwards immersed in cold water, and then very gradually warmed, its life has been preserved. The sudden application of heat never fails to occasion inflammation, and mortification very quickly follows. After the temperature has been gradually raised, and action and sensation are perceived, frictions with flannel wet with ardent spirit are to be used. The patient should then be placed in bed and kept warm; perspiration is to be produced by warm drinks, and by keeping him perfectly at rest, the ill effects will speedily subside.

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* A woman in a fit of intoxication was overtaken in a snow storm. "The snow accumulated over her to the height of about six feet, a sort of hollow cone being left from her head to the surface, through which breathing was performed; from this situation she was removed, after having laid eight days in the snow." Her life was preserved, though she lost great part of her feet. Other instances are recorded of long exposure to intense cold, without fatal consequences. Our present subject is more particularly the effects of its local application.

When mortification occurs, it has been my practice for several years to apply blisters, with a view to hasten the separation of the dead parts, and the ulcers left I have found to heal very soon when treated with basilicon rendered stimulating by the addition of a little spirits of turpentine.*

CHILBLAIN, is a local inflammation situated generally upon the heels, toes and fingers, but sometimes upon the nose and ears, resulting from exposure to cold. This inflammation varies in degree; when moderate, a redness is observed upon the skin, attended with heat and itching, which after a time, spontaneously subsides. In a greater degree the swelling is larger, of a deeper red colour, and sometimes purple, or dark blue; the heat, itching, and pain are very great. Sometimes small vesicles arise, which burst and occasion very obstinate ulcers. In the most violent cases mortification occurs, preceded by the usual vesications containing a dark coloured fluid.

Chilblains arise most frequently from exposure of the parts to sudden and great vicissitudes of temperature. They occur oftenest in persons accustomed to indulgence, in women and children.

They generally make their appearance in the winter, disappear during the summer, and return the succeeding winter. Some persons suffer most from them during the autumn, others not until spring; sometimes they continue a few days, or weeks, and sometimes during the whole winter. When violent the patient is unable to move about, and is affected with considerable fever. When suppuration occurs, the bone becomes carious, and even death has followed the irritation of a chilblain.

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* In cases of suspended animation from cold, there is no necessity for the very gradual application of heat; on the contrary, it is recommended to bring the patient into a warm room and rub him with flannels. His feet and legs are to be immersed in tepid water, and bladders filled with it are to be applied to the thorax.

To prevent the formation of chilblains in young persons, they should be accustomed to wash in cold water, and not to be much in very warm rooms, especially avoiding sudden changes from cold to heat, or the reverse.

The remedies for chilblains vary according to the degree of inflammation; the several remedies for inflammation however, do not relieve the pain and itching which attend this complaint, and one thing it is important to know, which is, that the remedies most successful in one case, produce no effect upon another; when inefficient therefore, they must be varied. In some cases great relief is obtained from lotions of a spirituous nature, alkohol, laudanum, brandy, and the like, and in others poultices afford most relief. Leeches are often useful where the inflammation is so violent as to produce fever; cold water or snow applied to the part, sometimes produces great relief; it should be repeated several times in the course of the day, and continued until the pain and itching abates. A bath of quicklime prepared by throwing a piece of fresh burnt lime as large as a man's fist into a quart of water, is recommended by Richter as a valuable remedy; the affected part is to be immersed in this bath, and kept in it half an hour every morning and evening.

Oil of turpentine affords in many cases great relief. Balsam copaiva, basilicon ointment, tar ointment, and various other resinous applications are found useful.

When chilblains ulcerate, they are to be treated as ulcers from other causes. When mortification takes place, poultices are to be applied until the sloughs separate, and then the sore is to be dressed in the usual manner.

CHAPTER IX.

Of Wounds.

A WOUND may be defined, a recent solution in the continuity of a part communicating externally, and produced by mechanical violence.

Wounds differ in their nature and appearances from an endless variety of circumstances. They admit, however of a general division into INCISED, and CONTUSED; the latter including *punctured, lacerated,* and *gun-shot* wounds. Incised wounds are made with a sharp cutting instrument, and the neighbouring parts sustain no injury. Contused wounds are those in which the surrounding parts are bruised and injured.

OF INCISED WOUNDS.

When these are of small extent, and made in fleshy parts, unaccompanied by a division of any considerable blood-vessel, the surgeon by approximating the sides of the wound and retaining them in contact, enables them to unite, and they very speedily heal. All incised wounds, however, are attended with some loss of blood, and this is in many cases so great, as to form the chief danger of the case; as there is no subject of more importance to the surgeon than that of hemorrhage, it will be proper in this place to offer some remarks upon it.

OF HEMORRHAGE.

In order to ascertain the natural process by which the bleeding from a wound is arrested, it is requisite to attend to the phenomena which follow the opening of large blood-vessels. It is now nearly a century since Mr.

Petit commenced the investigation of the present subject, and since his time a variety of theories have been advanced, to explain the natural means by which the bleeding from divided arteries is stopped. Dr. Jones in a late publication has collected into one view these various and discordant doctrines; has selected from each what appeared founded upon fact, and by very numerous and interesting experiments, seems to have gone far in developing the truth.

If the vessel opened be a large artery, an immediate jet or stream of blood is perceived; this blood is of bright scarlet colour, and issues, not in a regular current, but per saltum, every contraction and dilatation of the vessel propelling it with alternately greater and lesser velocity.*

"An impetuous flow of blood, a sudden and forcible retraction of the artery within its sheath, and a slight contraction of its extremity, are the immediate and almost simultaneous effects of its division. The natural impulse however with which the blood is driven on, in some measure counteracts the *retraction* and resists the *contraction*,* of the artery, the blood is effused into the cellular substance between the artery and its sheath, and passing through the canal of the sheath which had been formed by the retraction of the artery, flows freely externally, or is extravasated into the surrounding cellular membrane, in proportion to the open or confined state of the wound. The retracting artery leaves the internal surface of the sheath uneven by lacerating or stretching the cellular fibres that connected them. These fibres entangle the blood as it flows, and thus the foundation is laid for the formation of a coagulum at the mouth of the artery, and which appears to be completed by the blood as it passes through this canal of the sheath, gradually adhering and coagulating around its internal surface, until it completely fills it up from the circumference to the centre." (JONES.)

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* To comprehend this subject fully, it is necessary to recollect some circumstances connected with the anatomy of arteries, which we shall here very briefly state.

"The coats of an artery are three; the internal is extremely thin and smooth, it is elastic and firm in the longitudinal direction, *but so weak in the circular as to be very easily torn by the slightest force applied in that direction. It is vascular and capable of inflaming.*"

The middle coat is composed chiefly of muscular fibres, arranged in a circular manner; they differ from common muscular fibres in being more elastic. As this middle coat has no longitudinal fibres, *the circular fibres are held together by a slender connexion, which yields readily to any force applied in the circumference of the artery.*

"The external coat is remarkable for its whiteness, density, and great elasticity. *When an artery is surrounded by a tight ligature, its middle and internal coats are as completely divided by it as they could be by a knife, whilst the external coat remains entire.*"

"Besides these proper coats all the arteries in their natural situations are connected by means of the fine cellular substance with surrounding membraneous sheaths. *If an artery be divided, the divided parts, owing to their elasticity, recede from each other, and the length of the cellular substance, connecting the artery with the sheath, admits of its retracting a certain way within the sheath.*"

"Arteries are furnished with, arteries, veins, absorbents, and nerves, *a structure which makes them susceptible of every change to which living parts are subjected in common; enables them to inflame when injured, and to pour out coagulating lymph by which the injury is repaired, or the tube permanently closed.*"—(JONES.)

The diminished force of the circulation of the blood, its speedy coagulation, and its extravasation into the surrounding cellular texture, are circumstances which contribute greatly to put a stop to the hemorrhage. The coagulum which acts as a plug to the open orifice, is situated not actually within this orifice, but within its surrounding sheath, and as it is outside of the vessel, Dr. Jones has called it *external;* a coagulum however, is found within the arterial tube, as high as the nearest collateral branch, this is not sufficient in volume to fill up the vessel and adheres to the artery no where except at the divided extremity; this clot is called the *internal* coagulum.

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* The retraction refers to the diminished *length*, and the contraction to the diminished *volume* or diameter of the artery.

The wounded artery afterwards inflames and its vessels (like those of any other inflamed part) secrete coagulating lymph in sufficient quantity to fill up the extremity of the artery between the external and internal coagula. This lymph appears to unite these coagula together, and adheres firmly all round to the internal coat of the vessel. It is this secreted lymph which constitutes the permanent barrier to the flow of blood, and this barrier is rendered stronger by a contraction of the wounded extremity of the vessel, and by an effusion of lymph between its coats, and into the surrounding cellular substance, by which these parts become incorporated together very firmly. If the wound in the integuments remains open, the effused lymph connects the artery to the subjacent and lateral parts, and gives it a new covering which entirely excludes it from the outward wound.

The same circumstances are also remarkable in the portion of the vessel most remote from the heart. Its orifice is usually more contracted and its external coagulum smaller than the one which attaches itself to the other cut end of the artery.

The impervious extremity of the artery no longer allowing blood to circulate through it, the portion which lies between it and the first lateral branch, gradually contracts till its cavity is completely obliterated, and its tunics assume a ligamentous appearance; the external coagulum which in the first instance had stopped the hemorrhage is absorbed in a few days, and the coagulating lymph effused around it, by which the parts were thickened is gradually removed, so that they resume their cellular structure.

At a still later period the ligamentous portion is reduced to a filamentous state, so that the artery is as it were completely annihilated from its cut end to the first lateral branch; long however before this final change is accomplished, the inosculating branches have become considerably enlarged, so as to establish a free communication between the disunited parts of the main artery.

When an artery has been divided at some distance from a lateral branch, three coagula are formed: one of blood externally, which shuts up its mouth; one of lymph, just within the extremity of its canal, and one of blood, within its cavity, and contiguous to that of lymph. But, when the artery has been divided near a lateral branch, no internal coagulum of blood is formed.

The external coagulum is always formed, when the divided artery is left to nature; not so however, if art interferes, for under the application of the ligature it can never form. If agaric, lycoperdon, or sponge be used, its formation is doubtful, depending entirely upon the degree of pressure that is used; but, the internal coagulum of blood will be equally formed, whether the treatment be left to art or nature, if no collateral branch is near the truncated extremity of the artery; and lastly, effused lymph, which, when in sufficient quantity, forms a distinct coagulum, just at the mouth of the artery, will be always found, if the hemorrhage is permanently suppressed.

When, instead of a *complete* division of an artery, it is only *partially* divided or punctured, the cessation of bleeding is not so easily effected by natural means; hence it was the custom of the ancients in such instances to divide completely a punctured artery.

Mr. Petit appears to have given the best account of the process by which the bleeding from arteries *partially* divided are stopped. Dr. Jones, after a great number of experiments performed with a view to elucidate this subject, confesses that he has little to add to Mr. Petit's account.

The blood is effused into the cellular substance, between the artery and its sheath, for some distance, both above and below the wounded part; and when the parts are examined, a short time after the hemorrhage has completely stopped, we find a stratum of coagulated blood between the artery and its sheath, extending from a few inches below the wounded part, to two or three inches above it, and somewhat thicker, or more prominent over the wounded part than elsewhere.

Hence, rather than say the hemorrhage is stopped by a coagulum, it is more correct to say, that it is stopped by a thick lamina of coagulated blood, which, though somewhat thicker at the wounded part, is perfectly continuous with the coagulated blood lying between the artery and its sheath.

When an artery is punctured, the hemorrhage immediately following, by filling up the space, between the artery and its sheath, with blood, and consequently distending the sheath, alters the relative situation of the puncture in the sheath to that in the artery, so that they are not exactly opposite to each other; and by that means a layer of blood is confined by the sheath over the puncture in the artery, and, by coagulating there, prevents any further effusion of blood.

But this coagulated blood, like the external coagulum of a divided artery, affords only a temporary barrier to the hemorrhage; its permanent suppression is effected by a process of reparation, or of obliteration.

It has been doubted by many respectable surgeons whether arteries when wounded, can heal without an obliteration of the cavity of the vessel, in such a manner as to carry on the circulation of blood. The experiments of Dr. Jones upon a number of animals prove that in brutes this very generally happens, when the artery is wounded only to a small extent; the cicatrization in these cases is so complete, that no vestige of the wound can be perceived, either on the external or internal surface of the artery, and that even oblique and transverse wounds when they do not exceed one-fourth of the circumference of the vessel, are filled up, and healed by an effusion of coagulating lymph from their inflamed lips, so as to occasion little or no obstruction to the canal of the artery. It may still be questioned whether in the human body the same mode of union is effected.

When an artery of considerable magnitude is punctured, even by a sharp lancet, the circular fibres of the artery in most cases contract so much, as to separate the sides of the wound to a considerable distance from each other, it appears as if a piece of the vessel had been actually removed.* To effect the reparation here, a coagulum forms as explained by Mr. Petit, inside of the artery, and extends through the wound, to a coagulum situated on the outside of the vessel,† in this manner the aperture is temporarily closed, and the permanent closure depends on the secretion of coagulating lymph, which is poured out in considerable quantity, and in many cases (probably a large majority of cases) obliterates the arterial tube, but in some instances the artery heals as in the experiments upon brutes related by Dr. Jones, and then the cicatrization is completed without a destruction of the arterial cavity. Mr. Petit records an instance of this, and in professor Scarpa's learned treatise on Aneurism, I find another very decided instance in which this mode of union was effected in the brachial artery of a man. Scarpa denies that when the artery heals in this manner the cure is radical. He supposes the vessel weaker at the cicatrix than at any other part. A case of wounded brachial artery which healed without an obliteration of its canal may be found in the New York Med. and Phil. Journal, No. 4.

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* Such is the common opinion, but I have seen several cases of punctured arteries, in which no gaping was evident, the wound being a mere slit, the sides of which were nearly or closely in contact, though they had not united. As this has been the case in all the punctured arteries I have seen, I cannot doubt that it very often happens.

† The inner clot he calls "bouchon," a cork, or plug, the external is called "couvercle."

Having thus stated the natural process by which a wounded artery is repaired, we may next mention that these powers of reparation appear to exist in an inverse ratio to the size of the vessel, small vessels healing much more readily than large ones.

In incised wounds the flow of blood is always much greater than in contused wounds of similar parts. The effect which laceration has in preventing hemorrhagy may be estimated from a case related by Cheselden, in which a miller's arm was torn off, together with the scapula from the chest, of course some of the largest arteries of the body were divided, and yet no fatal hemorrhagy ensued. I have known a boy's arm ground off in a mill within a few inches of the shoulder, and so little bleeding resulted, as scarcely to stain his clothes. Dr. Physick has attributed this effect of contusion, 1st, To the diminished power of the vessels to carry on the circulation. In an incised wound the vessels are only injured at the divided surfaces; in a contused wound they are injured to a considerable distance and therefore circulate the blood less rapidly. 2dly, In a contused wound the blood escapes less readily by the external opening, and becomes extravasated into the cellular texture making lateral pressure upon the blood-vessels.* 3dly, The blood coagulates much more promptly in contused than in incised wounds, and this coagulation is a powerful barrier to the escape of the blood. The extremities of divided vessels are often actually killed by the contusion, and blood, when in contact with dead matter speedily coagulates. The coagulation of blood in the divided extremities of the vessels, forms another obstacle to hemorrhage.

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* The lateral pressure is increased by ecchymosis, from a number of ruptured blood-vessels which have no external communication, and bleed into the interstices of the neighbouring parts.

TREATMENT OF INCISED WOUNDS.

In the treatment of an incised wound, the first object is to stop the bleeding. In many cases a wound bleeds profusely at first, and gradually stops without any attention from the surgeon. In some cases moderate pressure upon the wound by holding its sides in contact, puts a stop to the flow of blood, and this, if no large artery be obvious, should always be tried. If, upon removing the pressure the wound continues to bleed, or if previously to trying this, a bleeding artery is observed, it must be taken up upon the point of a tenaculum, and a ligature applied round it.

If the bleeding is so great as to prevent an accurate inspection of the wound, so that the artery cannot be perceived, pressure must be made upon the trunk of the main artery which supplies the parts with blood. This pressure may be made with a finger, or if the wound be seated in an extremity, with a tourniquet; that of Petit is to be preferred for simplicity and facility of application to all others.* When the tourniquet is to be applied, it must be placed above the knee or elbow, because, as there is only one bone in these parts, a circular bandage will compress all the vessels of the limb. After the tourniquet is applied and screwed so tight as to interrupt the circulation, the surgeon is to wash the wound with a sponge and warm water, and then, whilst his eye is fixed on it, the screw is gradually loosened, and the divided vessels may be seen by the stream of blood escaping from their extremities.

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* I mean the tourniquet in common use, invented by Petit, and improved by Freke.

It is to be recollected, that if the wound be too high up on an extremity for the application of a tourniquet, the compression of the vessel may still be effected. The subclavian artery may be compressed as it lies over the first rib, and the circulation in the arm may thus be completely prevented, and from pressure in the groin, the trunk of the femoral artery ceases to pulsate. In every instance where the bleeding does not speedily cease, and the orifice of the bleeding artery can be seen, it is to be tied up. And whenever large arteries are wounded, there is no other mode of stopping the hemorrhage to be confided in.

Dr. Jones having made a number of experiments to ascertain the effects of the ligature upon an artery included in it, and properly tied, states, that the internal and middle coats of the artery are cut through and kept in close contact by the ligature; inflammation supervening they adhere and unite firmly.

There are however some situations in which it is extremely difficult to tie up a wounded artery. If a vessel be opened in a deep wound of small extent, it becomes sometimes necessary to dilate the wound, in order to expose it. Sometimes we are able by enclosing in the ligature a portion of flesh through which the artery passes, to put a stop to hemorrhage. In other cases the application of lint and moderate pressure effects the purpose (but this can only be trusted when the bleeding is from small vessels.) The application of stiptics and escharotics, is nearly out of use among surgeons; and yet cases sometimes occur, in which they may be employed with advantage, as when the bleeding vessel is beyond the reach of the ligature, and in such a situation, as to preclude compression.* I have once known the hot iron necessary to put a stop to a most alarming hemorrhage from a large artery in the posterior fauces, which had been wounded in extirpating a tumour from the mouth. It sometimes happens that a proper posture of a limb restrains hemorrhagy. The posture should be one in which gravity favours the descent of blood through the veins, and retards its motion in the arteries.

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* Powdered agaric. Flour sprinkled over the surface, by exciting coagulation often stops the bleeding, Sp. turpentine, alum, blue vitriol, the mineral acids, lunar caustic, &c. &c. &c.

The form of the ligatures used by surgeons is not an object of much consequence when the vessels are small; when a large artery however is to be secured, Dr. Jones recommends them to be round and very firm; he states, that though a slight force only is necessary to cut through the internal and middle coats of an artery, it is better to tie the vessel more tightly than is necessary, merely to cut through its inner coats, because the cut surfaces will be more certainly kept in contact, the separation of the ligature expedited, and the danger of ulceration spreading to the newly cicatrized part diminished. This direction of Dr. Jones, I believe useless, and except in the larger arteries, it is quite sufficient to tie the ligature with force enough to command the hemorrhage, and even in the largest arteries, I believe the direction has frequently induced surgeons to break their ligatures by unnecessary force.

I would here state, that round bobbin forms an excellent ligature for the larger arteries, and for smaller vessels, a number of sewing threads waxed together of a proper thickness may be used.

Shortly after the first edition of this work was published, Dr. Physick suggested to the author the propriety of testing by experiment, the value of an improvement he had long contemplated in the formation of ligatures—this was accordingly done, and has resulted in the substitution of certain animal substances for the materials formerly employed.

It has long been a desideratum among surgeons, to be able to remove the ligature from a wound after the blood-vessel on which it has been applied is healed. Many weeks, and in some cases months, have been found to elapse before the ligature is detached, during all which time the sore is prevented from healing, and in some cases hectic fever and a fatal termination have resulted. There can be no reasonable doubt entertained, that all the processes requisite for the complete obliteration of a blood-vessel, secured by ligature, are completed in a very short space of time, probably in two or three days.* It follows that if the ligature applied, be made of materials capable of securing the vessel during this space of time, and liable to decomposition and solution in the animal fluids afterwards, the requisite advantages will be obtained. Dr. Physick was induced to believe that leather would be found to possess these properties; he had remarked that the strips of adhesive plaster applied over ulcers, retained their strength of texture a few hours and then became dissolved in the pus discharged from the sore; should the leather be found to dissolve too rapidly, there were other animal matters which he proposed to substitute.

The first experiment made to ascertain the correctness of these opinions, was the application of a buckskin ligature to a large artery in a horse. It restrained the bleeding and was discharged in a liquid state in two or three days.

Sometime after this experiment, Dr. Hartshorne employed ligatures of animal matter for securing the blood-vessels in the human subject. He amputated a leg at the Pennsylvania Hospital, and tied up the vessels with strips of parchment, which were found to answer extremely well. At the first dressing the ligatures were found dissolved, and never occasioned any inconvenience.

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* Vide Travers' Experiments, in the 6th vol. Medico-Chir. Transactions.

Pursuing the enquiry, I performed a number of experiments with various animal substances, as catgut, parchment, various kinds of leather, &c. The best method of constructing ligatures which I have been able to devise, is by cutting French kid leather into strips, from a fourth of an inch to half an inch in width, peeling off what is called the *grain*, or coloured, polished surface: the strips are then wet and stretched—they gain greatly in length and are diminished in breadth by this process; and ligatures may be prepared of any requisite strength by varying the width of the strips. I have employed them in amputations, and in a number of the capital operations, and never have seen any occasion to regret their use, but on the contrary, to consider it one of the most valuable improvements in modern surgery.

I have not thought it requisite to leave the ligatures hanging out of the wound, after accidents or operations, but have cut them very close to the knot and treated the case as if no ligature were employed. In some instances union by the first intention has taken place, the ligature probably being dissolved and absorbed, at least it has never afterwards appeared, but in others suppuration and abscess have been produced.

Since the experiments above cited have been made, I find that Mr. Lawrence has proposed to cut off the ligatures after operations, close to the divided vessels. How well the practice may succeed where they are composed of durable materials, future experience may decide, but I cannot forbear the expression of a belief, that the animal ligatures will supplant all others except in a few particular cases which will readily suggest themselves to the surgeon. For example, in closing wounds of the abdomen, when they can be taken out at pleasure—in cases of hare-lip, &c.

The leather ligatures are rather more bulky than those made of thread or silk: a little practice, however, will enable the surgeon to make them very neatly, and to employ them in arming his needles, as conveniently as any others. In several cases in which I have amputated scirrhus breasts, and have necessarily removed much skin, I have from the heat of the weather, been induced to dress the patient on the third day, and at this period not a vestige of ligature has been observed, except at the upper part of the wound, when this has been dry, in which case the leather is not destroyed so rapidly.

The femoral is the largest artery I have as yet secured with a leather ligature; I should not, however, hesitate to employ one for tying any other vessel in the body when necessary. It would be easy by soaking the ligatures in linseed oil; or in certain resinous substances, to render them more durable, but I have not found this expedient necessary.*

When the bleeding from an incised wound is arrested, the next thing demanding the attention of the surgeon, is the removal of all extraneous matter; the clotted blood, dirt, &c. must be carefully washed away, and the sides of the wound are then to be approximated and kept in contact. The measures to be employed for this purpose are strips of adhesive plaster, compresses, bandages, and a proper position of the part, rest, and lastly sutures.

The *adhesive plasters* are in most cases sufficient, when aided by bandages and a proper posture, without the use of the needle. The sides of the wound being placed in contact, are to be held so by an assistant, and the surgeon is to apply strips of plaster spread on linen or leather across the wound. These strips should be of considerable length, so as to act on a large surface of sound skin, and from half an inch to an inch in width. They should be placed at a small distance one from the other, so as to allow the escape of any extravasated fluid through the interstices. If this caution be neglected, and the plasters placed so as to cover the whole wound, they often convert it into an abscess, by preventing an outlet for superfluous blood or serum, and in case of suppuration the pus is confined, the parts already united are torn asunder, and the inflammation is extended.

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* The first publication on this subject was made by Dr. Physick, in the Eclectic Repertory, dated July 9th, 1816.

If, from the small extent of the wound and other circumstances, there is reason to expect its union by the first intention, or by the adhesive inflammation, nothing more is necessary than to apply a compress of folded linen, or a pledgit of dry lint over the adhesive strips, and secure them by a few turns of a roller.

Should there be no good prospect of so speedy a cure, and reason to expect suppuration, a pledgit of lint spread with simple cerate, and covered with a pledgit of tow or folded linen, may be placed over the adhesive strips and confined by the many-tailed bandage, or roller; but it is of no importance to make any difference of treatment on account of the uncertainty respecting the manner in which the wound is to heal, and it is best to treat incised wounds generally as if the union by the first intention were certain. The pledgit of tow or linen which adds somewhat to the pressure, and is calculated to absorb any fluid which may escape from the wound, may readily be superadded if found necessary.

In all incised wounds the sides should be placed and kept as much as possible in contact. There can be no application to wounded flesh more natural or proper than the flesh from which it has just been violently separated, and if it do not adhere to it entirely, yet in all probability a very considerable part will, and thus the extent of the wound will be lessened.

The rapidity with which incised wounds sometimes unite, is really astonishing to any one not conversant with these wonderful powers of nature. I have seen a considerable tumour cut out from the breast, and in forty-eight hours a complete union of the wound had taken place. The wound may be examined in warm weather in forty-eight hours, in winter it is best not to disturb the dressings for three or four days.

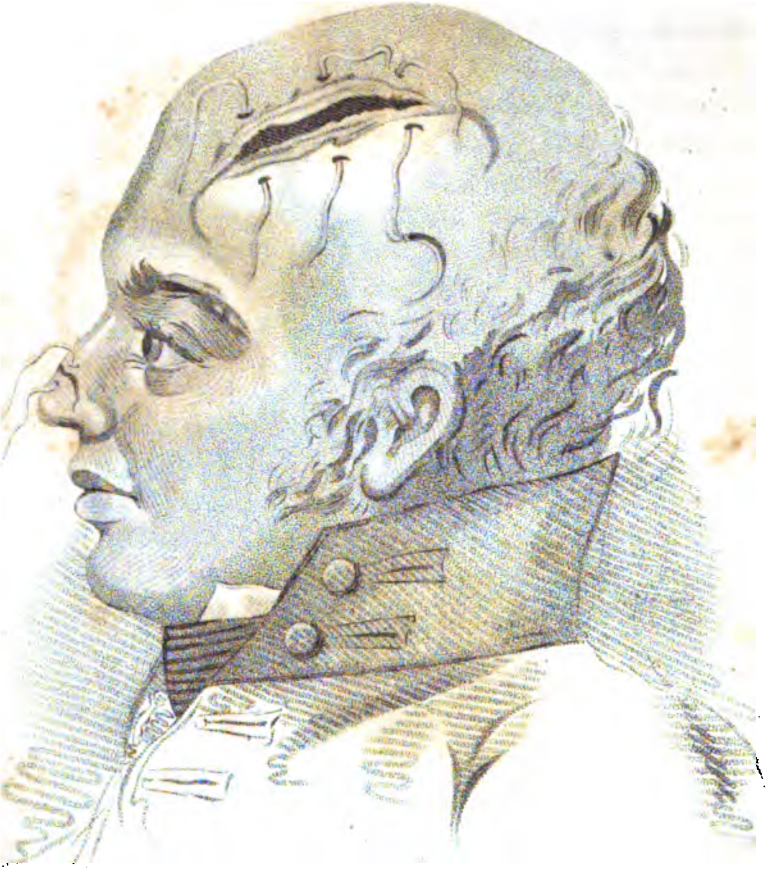
If fever and inflammation attend, the usual depleting remedies are to be used; if on the contrary, there be reason to apprehend tetanus, wine, opium, and a generous diet are to be prescribed.

The blood effused from the wound is in many cases the bond of union in incised wounds, but very often this is lost and adhesive inflammation supervenes; in this case the secreted coagulating lymph becomes the uniting medium, and this is soon assimilated to the wounded part, becoming bone, tendon, muscle, or skin, according as the wound has been in any of these parts. The cicatrix however, differs considerably from the originally formed parts.

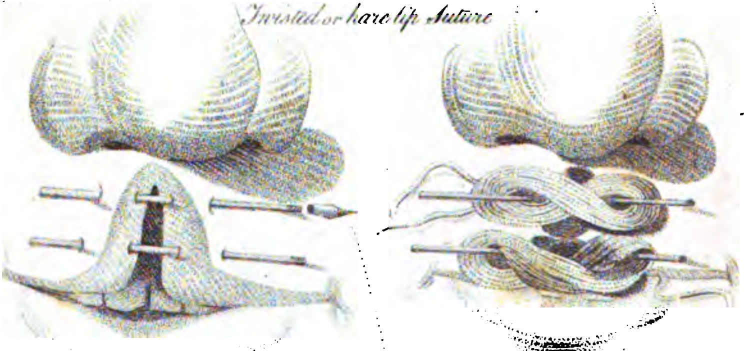
Posture is of great consequence in the treatment of wounds. The sides of a wound on the anterior part of the thigh cannot be kept in contact, unless the leg be kept extended upon the thigh; to aid the surgeon still more in relaxing the parts, the thigh should be flexed on the pelvis. A wound through the tendo achillis should be treated by extending the foot upon the leg, &c.

Sutures by attending to these preceding directions are very rarely necessary; and if possible they ought to be dispensed with, as they produce considerable pain, occasion great and permanent irritation by creating a number of punctured wounds, which are kept from healing by the ligature left in them; this ligature passes through a part of the original wound, and never fails to excite

Interrupted Suture.



Twisted or hare lip Suture



W. R. Jones sc.

suppuration in that part, in addition to these objections, sutures occasion deformity by increasing the extent and irregularity of the cicatrix.

Notwithstanding these objections, sutures are sometimes necessary in wounds of projecting parts, as the ears, nose, tongue, lips, scrotum, &c. Sometimes the peritoneum is wounded, and in these cases ligatures are necessary to keep its edges in contact. In all these instances the *interrupted*, or *twisted suture* are to be used. The *interrupted suture* consists in making the necessary number of stitches with an armed needle, and tying them in such a manner as to keep the sides of the wound together.* The *twisted suture* is chiefly used in wounds of the lip; in the annexed plate these sutures are represented. In the twisted sutures two or more pins of silver with moveable steel points are passed through the flesh, and a ligature twisted round them, so as to confine the sides of the wound in contact. In treating hare-lip, this suture is generally employed. The pins ought to be made of smooth silver wire, the extremities of which fit into steel points which are taken off when the ligature is applied. If these be not at hand, a piece of wire filed sharp at the end will answer, but after the ligature is bound on, the point must be cut off with a pair of scissors, or a file.

When ligatures have been applied upon bleeding arteries, the ends of them are to be left long enough to project a short distance out of the wound, they are to be left out of one of its angles, (the most depending if practicable) and the wound treated as we have already directed.

When in cases of incised wounds it becomes evident that union cannot be effected without suppuration, the adhesive plasters, and every pressure, every irritation are to be removed, and a soft poultice substituted. When suppuration is fairly established and granulations begin to form, the means already recommended for retaining the sides of the wound in contact, are to be resumed and a cure will generally be soon effected.

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* The knots should be on one side of the wound. It is right to have the needle shaped so as to form a regular segment of a circle, and to have two cutting edges continued from the point

CHAPTER X.

Of Contused Wounds.

In contused wounds, besides the simple solution of continuity, there is an injury of the adjacent flesh, greater or less according to the nature and violence of the force applied.

Contused wounds are produced by blunt instruments. It has already been remarked, that these wounds bleed less profusely than simple incisions, and the reasons of this difference have been explained.

The indications of cure are to prevent excessive inflammation, to wait for the separation of the bruised and dead flesh, and when suppuration is established and granulations form, to approximate and retain in contact the sides of the wound.

The best local application is a boiled bread and milk poultice. If inflammatory symptoms run high, blood-letting is to be directed. If great pain or irritation come on, opiates may be given; should gangrene result, a blister is to be applied.

Lacerated wounds partake of the nature of contusion, but there is a difference, as their mode of union proves. A severely contused wound never heals by the first intention, because there is an interposition of clotted blood and injured flesh, between the sound parts, whereas I have known half the scalp torn off in a lacerated wound, and the whole of it has reunited by the first intention, except the edges which were greatly bruised.

Punctured wounds have considerable depth, and very little external opening: they are made by pointed instruments, as a small sword, bayonet, nails, needles. They are attended with various consequences, according to the nature of the parts injured. In other wounds the nature of the mischief is generally apparent; in punctured wounds, the surgeon is unable to ascertain with accuracy the parts which are injured; important nerves, blood-vessels or tendinous fasciæ are sometimes wounded; very violent inflammation often follows a small punctured wound, and collections of matters are sometimes formed, great irritation occasionally occurs, the constitution suffers and fever comes on. Tetanus is a frequent occurrence after punctured wounds, though I have as often seen it a consequence of other contused wounds. Convulsions, tremour, and nervous affections, are also occasioned.

In the treatment of punctured wounds, the first thing demanding attention is hemorrhage. If any blood-vessel of considerable size have been opened, it must be sought for by dilating the orifice of the wound with a probe and scalpel; the vessel being exposed in this manner, should be tied up with a ligature. In some cases, the bleeding, at first profuse, gradually ceases, and although from the rapidity with which it flowed, there may be reason to apprehend the puncture of a large artery, yet the patient is unwilling to suffer his wound to be dilated in order to secure the vessel; and it is a fact that such vessels have sometimes healed without the interference of art. I have been informed of a case in which a very large artery in the thigh, probably the femoral,* was opened by a small sword, and although the stream of blood at first was very alarming, yet it soon ceased, and did not recur, until the tenth day, when an officious surgeon forced his probe into the vessel and the patient died in consequence of the bleeding; there is great reason to believe that this patient would have recovered but for the improper interference of his surgeon. Whenever therefore the bleeding ceases spontaneously, or after the wound is dressed, the patient should be kept still and watched carefully, as a return of hemorrhage is to be apprehended. If the puncture be on a limb, a tourniquet may be applied and left loose, so that an assistant may have it in his power in a moment to put a stop to the effusion of blood, until the artery is finally secured by a ligature.

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* I speak thus cautiously because there was no dissection, but I have no doubt that the wounded vessel was the femoral artery, because the stream of blood was so copious at first as to lead the surgeons present to that opinion.

The healing of a large artery, however, is an event seldom to be trusted to, and there is no surgical maxim of greater importance than the necessity of tying up all wounded arteries when it is practicable. It is only in cases where this cannot be done that the surgeon is to avail himself of other means for suppressing the hemorrhage. As all such means furnish important resources to the surgeon, I shall mention a plan which I have known successful in stopping the flow of blood from an artery in the foot. The patient was a child in whom several unavailing attempts to tie up the divided vessel had been previously made, and the wound was in a state of great inflammation. A compress was applied over the trunk of the anterior, and another over that of the posterior tibial arteries about two inches above the ancle: over these a strip of sheet copper was passed round the leg, and a tourniquet was applied over the copper; in this way, when the tourniquet was tightened, the tibial arteries were compressed, and the bleeding ceased, the copper prevented the tourniquet from compressing any other vessel, so that the circulation in the foot was not interrupted. In a few days the wound healed without any recurrence of hemorrhage. Probably in some analogous cases similar measures may be found successful.

When punctured wounds contain foreign substances which are easily felt, they may be dilated sufficiently to allow the extraction of these substances, but in most instances it is best to permit them to be discharged by suppuration.

When convulsions, or great nervous irritation follow, the dilatation of a punctured wound frequently puts an immediate stop to these symptoms; a small incision upon a probe passed into the puncture, will suffice for this purpose.

When punctured wounds occur in extremely hot weather, it is safest to enlarge them by the scalpel, or to apply stimulating substances to excite inflammation; there is reason to believe that tetanus has in this way been often prevented.

Erysipelatous inflammation in some instances follows punctured wounds, especially of the scalp; an enlargement of the wound has been found useful in these cases, and a blister should be applied over the inflamed parts.

These are the principal circumstances in punctured wounds, which call for dilatation; when suppuration is established, if matter be formed and confined, an outlet must be made for it as in any other case. The practice of dilating indiscriminately all punctured wounds is highly reprehensible. A soft poultice is the best local application. If the pain be great, opium may be administered, and if fever or inflammation run high, bleeding and depleting remedies may become necessary. They are always, however, and particularly in hot weather, to be prescribed with caution, as they certainly render the system more liable to tetanus; *punctured wounds* sometimes unite by adhesive inflammation, but if extensive they generally suppurate.

CHAPTER XI.

Of Gunshot Wounds.

SINCE the application of gunpowder to the purposes of war, a new class of wounds has attracted the attention of surgeons, the nature and peculiarities of which have only within a few years been well understood.

"Gunshot wounds are made by the forcible projection of hard obtuse bodies, the greatest number of which are musket balls.

"They vary according to the kind of body projected, the velocity of the body, and the nature and peculiarities of the parts injured. The kind of body projected, is principally musket balls, sometimes cannon balls, sometimes pieces of broken shells, and very often on board of ship, splinters of wood. The effects of cannon balls on different parts of the ship, are the principal causes of wounds in the sailor, for a cannon ball must generally pass through the timbers of the ship before it reaches him; a greater number will be wounded by the splinters thus torn off, than by the ball itself. The wounds occasioned by these splinters, differ in no respect from contused and lacerated wounds from other causes.

"Gunshot wounds are in general contused wounds, from which contusion there is most commonly a part of the solids surrounding the wound deadened, as the projecting body forced its way through these solids, which is afterwards thrown off in form of a slough, and which prevents such wounds from healing by the first intention, or by means of the adhesive inflammation, from which circumstance most of them must be allowed to suppurate. This does not always take place equally in every gunshot wound, nor in every part of the same wound; and the difference commonly arises from the variety in the velocity of the body projected; for we find in many cases, where the ball has passed with little velocity, which is often the case with balls, even at their entrance, but most commonly at the part last wounded by the ball, that the wounds are often healed by the first intention.

"Gunshot wounds, from the circumstance of commonly having a part killed, do not generally inflame so readily as those from other accidents; this backwardness to inflame, will be in the proportion that the quantity of deadened parts bear to the extent of the wound.

"From the circumstance of a part being deadened, a gunshot wound is often not completely understood at first; for it is at first, in many cases, impossible to know what parts are killed, whether bone, tendon, or soft part, until the deadened part has separated, which makes it a much more complicated wound than at first was known or imagined; for it very often happens, that some viscus, or a part of some viscus, or a part of a large artery, or even a bone, has been killed by the blow, which does not show itself till the slough comes away. If for instance, it is a part of an intestine that has received a contusion, so as to kill it, and which is to slough, a new symptom will most probably appear from the sloughs being separated, the contents of the intestine will most probably come through the wound; and probably the same thing will happen when any other containing viscus is in part deadened; but those cases will not be so dangerous, as if the same loss had been produced at first, for by this time all communication will be cut off between the containing and contained parts; nor will it be so dangerous as when a considerable blood-vessel is deadened; for in this case, when the slough comes off, the blood, getting a free passage into the wound, as also out of it, probably death will immediately follow. If this artery is internal, nothing can be done; if in an extremity, the vessel may generally be taken up. When the bone is deadened, an exfoliation must take place." (*Hunter.*)

The velocity with which the ball passes has a great influence on the circumstances of these accidents. If the velocity be small, there is not so great a chance of their being compounded with fractured bones; but if the velocity be sufficient to break the bone it hits, the bone will be much more splintered than if the velocity had been very considerable, for where the velocity is very great, the ball as it were, takes a piece out. In a very hard bone the splinters will be most numerous. The direction of a ball is influenced by the celerity of its motion. If it move with but little force, it is easily altered from its straight direction, by a bone; where the velocity is greatest, the course is most direct.

The greater the velocity of a bullet, the greater will be the extent of the deadened parts, consequently the slough is always greater at the entrance than at the exit of a ball, and in some cases the part at which it passes out, heals by the first intention or by suppurative inflammation without casting off any slough.

Gunshot wounds like all other contused wounds, bleed less than simple incisions, the explanation of this has already been offered. If, however, large vessels are killed by the ball, when the sloughs separate there will be great danger of hemorrhage from the opening formed in the artery.

There is very frequently extraneous matter contained in gunshot wounds, as the bullet carries in with it all the clothing which had been on the wounded part, and often remains itself in the wound, much altered in form from the effects of bones upon it. I have seen a bullet beat out nearly as thin as paper, by passing through a rib and lodging in one of the vertebræ. These extraneous substances however do less mischief than in any other kind of wounds, because as they are in contact with dead parts, they occasion no irritation, and as these dead parts are themselves foreign matter and must be discharged by suppuration, the wound is not much delayed in healing by their presence.

TREATMENT OF GUNSHOT WOUNDS.

The various phenomena of gunshot wounds, being of a nature not very readily explained by the older surgeons, induced some to believe that they were poisoned, others imagined the ball to be intensely hot, and supposed the peculiarities of these accidents to depend on the burning of the sides of the wound. The essential difference, and the only difference between gunshot and other contused wounds, is found to consist in the death of those parts through which the ball has passed, and the necessity for the separation of these parts before union can be effected.

It was formerly the custom to dilate all gunshot wounds, and much mischief has resulted from the practice. There is nothing in the nature of this kind of accident that calls for dilatation in every case, nor is there any thing forbidding the practice when particular circumstances render it proper. If an artery be opened by a gunshot wound, and the enlargement of the wound by a knife will enable the surgeon to tie it up, he ought surely to perform the operation. In general it is unnecessary to dilate a gunshot wound for the purpose of extracting a bullet or other extraneous matter, because suppuration must come on, and this process will generally effect the object. If extraneous matter is perceived, and can easily be removed, it may be done; but it is wrong to enlarge the wound or take much pains to effect, what will be more readily done at a future period. The same reasons which would induce a surgeon to dilate a punctured wound, or any other kind of wound, should lead him to dilate a gunshot wound, these reasons have been already stated.

When a ball can be found without difficulty, it is right to extract it by means of forceps, the course of a ball however is so extremely irregular, that we are not always able to find it. The glancing of balls is in many cases very surprising. Mr. Hunter has seen a bullet enter the skin over the tibia, and pass round the leg under the skin without injuring either the bone or the skin. Wiseman relates cases where balls have passed through joints without occasioning an injury to the bones or cartilages. When the velocity of a ball is nearly spent, a slight resistance will turn it from its course; balls have been known to pass round half the skull between the cranium and scalp, and then pass out opposite the part at which it entered. In the same way they have passed round the thorax, and glancing from a rib and kept from passing out by the resistance of the skin. Mistakes have been occasioned by these irregularities, and bullets are said to have passed through the head and chest in many cases where no such thing has happened. The posture of the body when the wound was received, should be attended to when the course of a bullet is searched for; a ball has entered the arm and been found on the opposite side of the body, owing to the horizontal posture of the limb when wounded.

In many instances balls pass immediately under the skin to a considerable distance, their course being marked by a red line extending from the spot where it entered, to that at which it escaped or is lodged. *Where bullets are lodged superficially under the skin, they may with great safety and propriety be cut out, and no mischief in general arise from this new opening.* The propriety however of extracting balls thus situated has been questioned, and Mr. Hunter remarks, that if the skin over it be quite sound, he would "in that case advise letting it alone, until the wound made by the entrance of the ball had inflamed and was suppurating." His reasons for this direction are, "1st. We find that most wounds get well when the ball is left in (excepting it has done other mischief than simply passing through the soft parts) and that very little inflammation attends the wound where the ball lodges, only that where it enters, the inflammation not arising so much from the injury done by the ball, as from the parts being there exposed to the suppurative inflammation, if it is immediately removed. There is always a greater chance of a slough where the ball enters than where it rests, arising from the greater velocity of the ball, for beyond where the slough is, the parts unite by the first intention."

"2dly. In those cases where the ball passes through and through, we have two inflammations, one at each orifice, instead of the one at the entrance, or a continued inflammation through and through, if the ball has passed with great velocity. Where the ball makes its exit, the inflammation passes further along the passage of the ball, than when the wound has been healed up to the ball and then cut out afterwards, so that by opening immediately the irritation will be extended further, and of course the disposition for healing will be prevented. If this is the case, I think that two wounds should not be made at the same time, and what convinces me more of it is, that I have seen cases where the balls were not found at first, nor even till after the patients had got well of their wounds, and these balls were found very near the skin. They gave no trouble (or else they would have been found sooner) no inflammation came upon the parts, and afterwards they were extracted and did well."

"Again I have seen cases where the balls were found at first, and cut out immediately, which were similar to balls passing through and through: the same inflammation came on the cut wounds that came on the wounds made by the entrance of thè ball."

On these remarks of Mr. Hunter, I beg leave to offer a few observations. A musket or pistol bullet will doubtless in a majority of cases excite no unpleasant symptoms, the parts will heal around it forming a sac; but a bullet is always extraneous matter, and in a majority of cases carries with it other extraneous matter, cloth, linen, &c. which cannot fail to irritate the flesh in which they lodge; they act like setons in keeping up suppuration and preventing the union of the wound, effects which I have witnessed in several cases; in one a very large abscess was formed on the back in consequence of a ball being suffered to remain nineteen days under the skin near the angle of the scapula.

It is with great diffidence that I would venture to oppose on a practical point, the authority of Mr. Hunter, but I cannot but believe it right whenever a ball presents itself in such a situation, as that it may be extracted with facility, and without risque of injuring any important part to remove it immediately, without waiting for suppuration. The wound made by the knife may commonly be healed by the first intention. The ball should be suffered to remain whenever it is deeply buried in the flesh. All other extraneous matter if easily removed should be extracted, but probing or other violence must be avoided; the finger is to be preferred to all instruments in examining gunshot wounds.

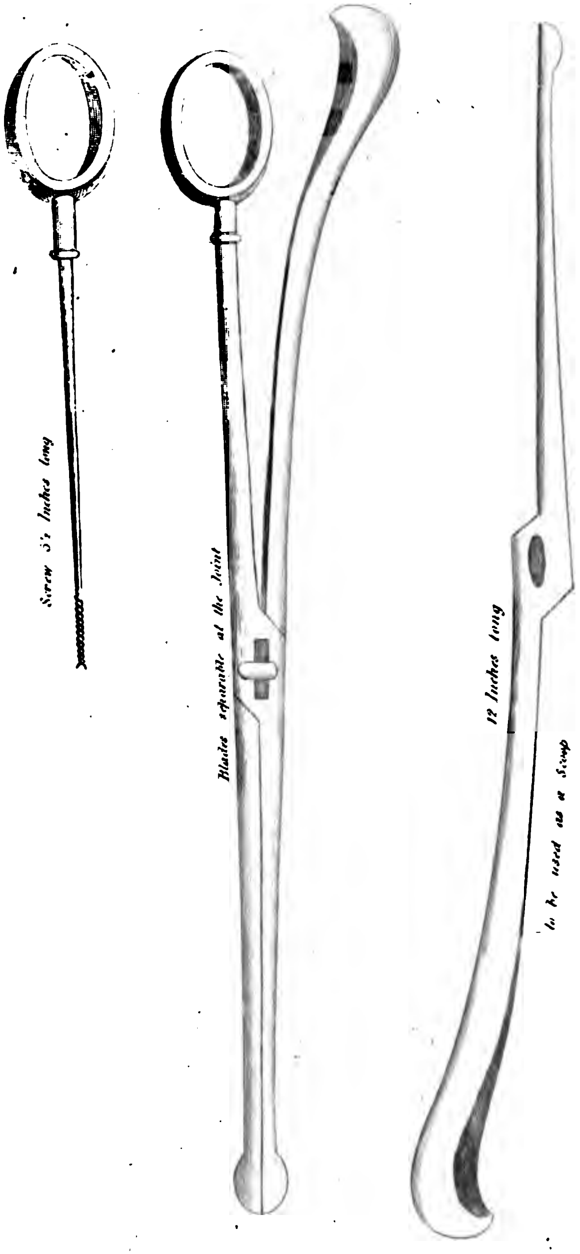
Sometimes bullets are lodged in the substance of the bones, all violent attempts to remove them are wrong; the bone will exfoliate, and when suppuration takes place, the ball will be discharged. In some cases balls and other extraneous matter have remained in bones or in the soft parts during life, without exciting any unpleasant effects, but sometimes they produce suppuration and are evacuated long after the wound has healed. A very remarkable instance of this kind, I shall quote from a letter with which I have been favoured by Mr. John Randolph, of Roanoke. Major S. was wounded in the arm at the battle of Germantown: "the wound healed, but was occasionally painful and once or twice suppurated and healed again. At length, about twenty-five years after the injury had been received, the wound broke out for the last time, when a small shred of woollen cloth, recognized by the patient as a portion of his coat, and another of linen, were discharged; they seemed to have undergone no sensible alteration except saturation with the pus and sanies in which they were immersed."

For the removal of musket balls, a variety of forceps have been constructed. A prize was given by the French Academy of Surgery to Mr. Percy for one which appears to answer extremely well. The instrument is represented in Pl. II. When a leaden ball is lodged in a bone, the screw which is contained in one of the handles may be easily made to enter it, and it can be extracted. This screw, however, is so seldom needed, that it is omitted in the bullet forceps used in the service of the United States.

When an extremity has been shattered by a cannon ball, the extent of injury is in some instances so great as to require the immediate removal of the member, we shall mention the circumstances which call for this operation, when we treat of amputation.

The best local application to a gunshot wound, is a soft poultice of bread and milk, or linseed, to be continued until the sloughs separate and suppuration is established. The treatment is to be similar to that of any other contused wound. The state of the constitution must be very carefully attended to.

Percy's bullet Forceps



When there is reason to apprehend that the parietes of any considerable blood-vessel has been killed by the ball, great care should be taken to attend to the separation of the sloughs, as serious and fatal hemorrhages have sometimes resulted from neglecting this caution.

When bones are injured, the soft parts in some cases heal up, and when the injured bone exfoliates, an abscess forms, and the wound must be opened afresh.

CHAPTER XII.

Of Poisoned Wounds.

Poisoned wounds are those attended with an introduction of certain healthy or morbid secretions of animals or vegetables capable of producing disease and death; as the bite of a venomous reptile, of a rabid animal, or a wound with a poisoned arrow.*

The sting of a bee, wasp, or hornet, the bite of a musquitoe, and certain other insects, although in degree very moderate, probably partake somewhat of the nature of poisoned wounds. It is unnecessary to say much of these. Although frequent in their occurrence, they are generally not so severe as to require medical aid. The sting of a bee, wasp or hornet, is always extremely painful, and is followed by inflammation, and sometimes by great tumefaction. Cold applications afford great relief. Cold water or lead water may be used. When the patient has been attacked by a swarm of these insects, and his head and face (which generally in these cases suffer) are much swelled, bleeding and a purge become necessary.

The bite of the musquitoe is in some parts of our country extremely annoying, and excites considerable inflammation, attended with intolerable itching. In some rare instances, owing probably to peculiarity of constitution, gangrene has resulted from the bite of this insect. I once knew a case of it fatal in a lady of this city, whose health previously was very good. Camphorated spirits, brandy, or vinegar, generally afford relief of the itching, and the inflammation in a few hours commonly subsides. Violent rubbing to allay the itching should be avoided.

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* With respect to the manner in which poisons act in producing death, the reader is referred to Fontana; the late experiments of Mr. Magendie upon the "upas tieute," and also to the interesting experiments of my friend Mr. Brodie, related in the Transactions of the Royal Society of London.

The rattlesnake, one of the most venomous reptiles in the world, is found in many parts of our country.* Like the cobra de capello in India, the bite proves speedily fatal, and we have very few histories of the effects of the poison.

Professor Barton, whose indefatigable labours have thrown light on every branch of physical science, has published in the 3d vol. of American Philosophical Transactions, a valuable paper on the subject, to which the reader is referred for much interesting information.

It appears from Dr. Barton's remarks, and from the observation of others, that "in the season of supervening languor and torpidity, the rattlesnake in particular bites with seeming reluctance, and without any or with but little ill consequence arising from the wound;" and "even in those seasons when the sun powerfully exerts its influence, at which times these animals are best qualified to strike and to injure, individuals of the species must be often found, the cavities of whose venomous fangs are entirely or nearly destitute of their active poison, from the introduction of which into their body those alarming symptoms which characterise the successful bite of this animal arise." Three chickens were bit by a rattlesnake kept in a cage, on three successive days. The first died in a few hours; the second survived much longer than the first; the third swelled much, but nevertheless recovered. On the fourth day several chickens were bitten, without receiving any injury. These circumstances are mentioned by Dr. Barton, to shew that the various supposed vegetable specifics for the bite of the rattlesnake owe their reputation to their having been used in cases where no bad effects would have resulted.

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* There are several species of crotalus. I refer to the "crotalus horridus," which is the most common species.

As the poison of the rattlesnake "exerts its principal effects on the sanguiferous system," immediate care should be taken to cut off the circulation of blood through the wounded part. When the poison enters a considerable vein or artery, death in general speedily ensues; often in the space of two minutes. Of this Dr. Barton has been assured from a variety of sources, although he is unwilling to believe the wound necessarily mortal. The wound being generally in the lower extremities, he recommends the immediate application of a tight ligature round the limb, to prevent the access of the poison to the circulation either by the veins or absorbents. "As poisons of various kinds are liable to be detained for some time in the glandular appendages of the absorbent system, it would perhaps be of use to scarify these parts, and apply a blister to them, in order to promote the discharge of the poison." When the glands in the groin swell, as they speedily do after a bite in the foot, the scarifications are to be made there, and a prompt vesication excited by the bark of the Daphne Gnidium.

I think there can be no doubt of the propriety of extirpating immediately the wounded part, as this will effectually cut off all communication with the circulating blood. The use of the numerous vegetable remedies which have been employed in these cases appears entitled to but little attention. The internal administration of volatile alkali has been very often employed, but probably its virtues are much overrated.

"When the poison of the rattlesnake has actually been introduced into the general mass of blood, it begins to exert its most alarming and characteristic effects. A considerable degree of nausea is a very common symptom. We now discover an evident alteration in the pulse; it becomes full, strong and greatly agitated; the whole body begins to swell; the eyes become so entirely suffused, that it is difficult to discover the smallest portion of the adnata that is not painted with blood. In many instances there is an hemorrhage from the eyes, and likewise from the nose and ears; and so great is the change induced in the mass of blood, that large quantities of it are sometimes thrown out on the surface of the body in form of sweat. The teeth vaccillate in their sockets, whilst the pains and groans of the unhappy sufferer too plainly inform us that the extinction of life is near at hand."

"In this stage of its action, and even before it has induced the most alarming of the symptoms which I have mentioned, the powers of medicine can do little to check the rapid and violent progress of this poison. The employment of the ligature, the use of the blister, and of the other modes of treatment which I recommended in the local stage, it is obvious to remark, will be of little, if any benefit here." (BARTON.)

Perhaps the same remarks will be found applicable in cases of bites from the other venomous serpents of America, but my own experience does not warrant me in offering any thing on this subject.

The bite of rabid animals is in all instances to be treated by extirpation with the knife, and when any doubt exists as to the removal of all the injured parts, caustic should be applied, so as to render their separation absolutely certain. This is to be done even if months have elapsed after the healing of the wound, upon the principle of leaving nothing undone which can possibly be instrumental in preventing so terrible a disease as hydrophobia.

Inoculation with morbid poisons is foreign from our present subject, and with respect to poisoned arrows, and the effects of the "upas tieute," I refer to the experiments of Mr. Magendie.

CHAPTER XIII.

Of Particular Wounds.

THE SCALP is liable to all the varieties of incised and contused wounds; they are often accompanied with injuries of the brain. A mere wound of the scalp is to be treated as a similar wound in any other part. The hair is to be carefully shaved, the extraneous matter removed, the divided parts replaced in contact, and secured so by adhesive plaster, or if necessary, by stitches. The vessels of the scalp seldom bleed so as to require the use of a ligature. When a large artery, however, is opened, as the occipital, or one of the principal branches of the temporal, it must be taken up: the needle is found more convenient for tying up arteries in the scalp than the tenaculum.

Punctured wounds of the scalp often occasion violent inflammations, in consequence of the parts underneath the tendon of the occipito frontalis muscle being injured. The usual remedies for inflammation relieve it.

In extensive lacerated wounds great portions of the scalp are separated, leaving the pericranium, and in some places, the bone bare. It was the practice formerly to remove all such detached portions by the knife, than which nothing can be more absurd. The doctrines of adhesion, taught by Mr. Hunter, have in this, as in many other important instances, triumphed over the barbarisms of former ages, and demonstrated the propriety of preserving, in every instance, the separated scalp. The parts are to be cleansed and placed in contact, and they will generally unite by adhesive inflammation; and if suppuration should even take place, granulations will form, and the union, though more tardy, will be equally certain. I have seen nearly one half the scalp torn off, and covered with dirt and splinters of wood, which, when carefully cleansed and replaced, united in a few days with very little suppuration.

WOUNDS OF THE FACE.

The face is liable to the various kinds of wounds which have been described, and they require no particular mode of treatment from their situation, except that it is of peculiar importance to make the cicatrix as small and as smooth as possible, to prevent deformity. Sutures are of course to be avoided, and sticking plaster to be used. In wounds of the eyelid, however, it sometimes happens that a stitch or two is necessary. In these cases care must be taken not to pass the ligature through the adnata, as in that case great irritation will be the consequence.

In the treatment of WOUNDS OF THE EYE, the great objects are to extract all foreign matter and to make use of very powerful measures to prevent and relieve the inflammation of this important organ. The various remedies for inflammation of the eye will be detailed when we speak of ophthalmia.

Where the LIP is cut through, if the wound be small, sticking plaster will be found sufficient to keep its sides together; but if it be half an inch or more in extent, the interrupted or twisted suture will be necessary. When the TONGUE is cut, stitches must be used. In children we often find the tongue wounded by the teeth in consequence of falls. A hook is in these cases generally necessary to keep the tongue sufficiently forward to enable the surgeon to perform the operation. A piece of soft wood should be placed between the teeth to prevent the child from biting the surgeon. In the course of six or eight days the stitches may be removed. During the cure the child should not be allowed to chew any solid food, but must be nourished entirely on fluids.

When the EARS are wounded, if a portion is nearly detached, stitches are necessary; but in many cases the adhesive plaster is found equally effectual, and should therefore be preferred.

Contused wounds of the face are to be poulticed until suppuration commences and granulations form, and then the adhesive strips are to be applied.

WOUNDS OF THE THROAT.

From the important parts which are here situated, and from the magnitude of the blood-vessels generally divided, wounds of the throat are among the most dangerous to which the surgeon is called.

Superficial wounds of the throat require no particular treatment, but generally heal as readily as wounds of other parts. Sometimes, however, the trachea is divided, together with large veins and arteries, even the œsophagus, and carotid artery, without immediate death.—Whenever the carotid artery is opened freely by a sharp instrument, fatal hemorrhage very promptly takes place: but Mr. Abernethy has recorded an instance in which a lacerated wound of this vessel was occasioned by the horn of a cow, and the bleeding was not attended with fatal consequences. Wounds of the throat most frequently occur in attempts to commit suicide; and as the instrument is commonly a razor or very sharp knife, the hemorrhage is profuse, and is always the first thing demanding attention.

Every bleeding vessel should be immediately secured by a ligature. The external jugular veins are generally opened, and these, as well as the divided arteries, are to be tied. The carotid itself should be tied up, if the surgeon arrive in time to effect it. Mr. Abernethy, in the instance just noticed, secured this vessel by a ligature, and his patient survived thirty hours. He remarks that, "should it become necessary at any time to tie the carotid artery, it may be done without much difficulty or danger, even without an accurate dissection of the part. If the incision be made on that side of the artery which is next the trachea where no important parts can be injured as was done in the present instance, the finger can then be passed behind the artery so as to compress it. The vessel being sufficiently bulky and firm to make its form and outline distinctly perceptible, a needle may then be passed behind the artery as near as possible to that edge of it which is next to the internal jugular vein; there can be little risk of wounding that vessel, or of including in the ligature the eighth pair of nerves which lies between them. In attempting to secure the carotid artery, I passed behind it in the manner described, a blunt hook with an eye in the point, and having previously introduced a ligature into it, I drew back the instrument and thus enclosed the artery.

In an incised wound of the carotid artery a very different and much more expeditious method would be necessary. The operation has hitherto never been done, but a case may possibly occur in which the surgeon may be present. In such a case I can see no impropriety in passing a sharp armed needle round the carotid without attending to nerves or any thing else. This ligature being given to an assistant, a second should be instantly passed in the same manner round the upper orifice. The hemorrhagy could now be restrained until the wounded vessel could be drawn out separately with a tenaculum or forceps, and both its cut extremities tied; after which the first ligatures which had been used as tourniquets should be removed.

The hemorrhage being stopped, the sides of the wound are to be brought together, if possible without the use of stitches. Where the trachea is only partially divided, adhesive plaster may always be used; if it be cut completely through, it is generally recommended to make use of the interrupted suture; but in some cases the stitches occasion great irritation, and are ulcerated out before the union of the wound, leaving it in the same state in which it had been before the use of the needle. The interrupted suture is, however to be used, whenever the wound of the trachea cannot be approximated without it; and whenever it is used, great care must be taken to pass the needle merely through the cellular texture surrounding the trachea, as the thread, if allowed to pass through the inner membrane of this canal, would add greatly to the irritation. In addition to this the head must be bent forward so as to favour the approximation of the sides of the wound, and it is to be kept so by bolsters and bandages: care, however, is necessary in all such cases, to guard against a collection of blood or mucus in the trachea, as death has been occasioned by a neglect of this caution. Whenever blood flows in this way into the trachea, and is not readily coughed up, the wound should be opened, in order that it may be discharged.

Where the œsophagus is also opened, it is difficult, unless the external wound be very extensive, to make any application to it. Desault in these cases recommends the introduction of an elastic catheter of large size, through which the necessary food may be injected into the stomach, and this practice has been found extremely useful in a number of cases. It should be suffered to remain during the cure, and will produce no ill effect, but on the contrary will preclude all that irritation which would arise from the action of the muscles in attempts to swallow. The tube may be passed either through the mouth or nostril, according to circumstances. The œsophagus is sometimes punctured by a sword, bayonet, or knife, without any wound of the trachea. In this case, if the blood-vessels escape, the wound generally heals readily.

The great contraction of the parts in large wounds of the throat produces a very unpleasant appearance of loss of substance. I have seen several cases in which scarcely any soft parts intervened between the lower jaw and the sternum; the throat seemed to have sunk into the thorax, or to have been cut away and removed. In the Medical Commentaries a case is related by Mr. Stark, in which this retraction was so great that "between the clavicles and os hyoides there was only one continued gash, which looked as if the windpipe and gullet had been cut out entirely." In these cases great attention must be paid to keeping the head close to the top of the chest.

Longitudinal wounds of the trachea heal in general without difficulty by the application of sticking plaster.

It has been doubted by some surgeons, "whether the œsophagus can ever be wounded without destroying at the same time the large blood-vessels and nerves, so that the patient must instantly die."* There is no doubt that the escape of food and liquids through the external opening has been considered a proof of a wound in the œsophagus in cases where the knife or razor has passed above the os hyoides and entered the mouth; but it is equally certain, that in many cases the trachea has been completely divided, and the œsophagus not merely opened, but cut nearly asunder, the wound extending almost to the cervical vertebræ, without injuring the carotid arteries. Mr. Stark's case was of this kind. "The pharynx was cut through, except about a finger's breadth of the back part." I have seen a case nearly similar, in which the trachea was cut completely asunder, and the œsophagus opened, without any wound of the carotid arteries.

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* Latta, Vol. III. p. 184.

CHAPTER XIV.

Of Wounds penetrating Cavities.

The thorax and abdomen are sometimes opened, and very dangerous consequences often result, especially if any of the viscera contained in these cavities be injured.

WOUNDS OF THE THORAX.

When the thorax is wounded to a depth sufficient to open the cavity of the pleura, the admission of air produces an immediate collapse of the lung, and breathing is performed with great difficulty. The lung so completely fills the cavity of the chest that it is generally injured in gunshot wounds and in stabs with a dirk or sword. When this is the case blood is coughed up. If a considerable blood-vessel is opened either in the parietes of the thorax or in the lung, blood collects in the cavity of the chest, produces great oppression, and increases the difficulty of breathing.

When the wound is a simple incision through the parietes of the thorax, it should be dressed with adhesive plaster, its sides being accurately brought in contact. A compress should be next applied, and over this a roller moderately tight round the chest. The patient should be kept at rest, and observe a strict antiphlogistic regimen, and be bled to prevent the accession of inflammation. Treated in this way, incised wounds of the thorax very generally heal without difficulty. The great object of the surgeon in every such case is to effect as speedily as possible the union of the wound, because whenever the cavity of the thorax is opened, unless union by the first intention or by adhesive inflammation takes place, violent inflammation comes on, frequently followed by fatal consequences.

The practice of closing the external wound after a violent effort to force out the air from the pleura, and indeed all attempts to draw the air out from it, are unnecessary; the wound may be closed without attending to the state of respiration, and the air left in the cavity of the chest will be absorbed without occasioning any ill effects.

The great anxiety which has been shewn to evacuate the air, originated in an opinion that the air of the atmosphere is a violent irritant, capable of exciting great inflammation: an opinion not at all founded in truth. In the year 1790, Dr. Physick injected air into one side of the thorax of a kitten, through a small puncture between the ribs. The wound healed by the first intention, and appeared to occasion very little inconvenience to the animal. On the fourth day the kitten was killed, and not a vestige of inflammation was observable. Many cases have occurred in the human subject in which the cavity of the pleura has been filled with air in consequence of a wound, and the wound being speedily healed, no inflammation has resulted. I once saw an officer who had been wounded with a dirk; the air entered and passed out of the wound freely during respiration; this wound united by the first intention, and in a week he was completely well, not having experienced a single symptom of thoracic inflammation.*

It happens in many cases that the existence of pulmonary disease occasions adhesions between the pleura costalis and pleura pulmonalis, in such a manner as partially or even totally to obliterate the cavity of the pleura. When a wound is received in the chest under these circumstances the danger of inflammation is much diminished.

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* It is remarkable that the French surgeons, and indeed many others, retain this strange notion of the irritating nature of atmospheric air. The principal case in which it irritates, is when it occasions fermentation in the cavity of an abscess.

Whenever inflammation comes on in consequence of a wound in the chest, bleedings, copious and repeated, must be employed; all the remedies for inflammation are to be vigorously administered, and in general they are successful.

When the lung is wounded, the patient will cough up blood, and if a large vessel be opened, (and a great number exist in the thorax of the largest size) fatal hemorrhagy will in general quickly ensue, and yet the heart itself has in some cases been wounded, and also the aorta, without immediate death.

There is reason to believe that the heart has often been slightly wounded without fatal consequences, and Dr. Babington has related a very interesting case in which the heart was wounded by a bayonet without immediate death. The patient was a marine on board a ship of war, and acting as sentinel at the gangway, fell through to the lower deck, and caught upon the point of his bayonet. "It entered his side a little below the false ribs, nearly in a perpendicular direction, and had penetrated to its hilt, having sustained the weight of his whole body. The poor man at the time did not feel himself much wounded. He drew out the bayonet without assistance, rose, lifted his musket, said he was not much hurt, and, as if he thought himself still fit to continue sentinel, walked eight or ten steps, then dropt down suddenly in a faint. On being laid in a horizontal posture he soon recovered, and was brought to the hospital (at Haslar) about 7 o'clock in the evening, which was about two hours after the accident. He then made very little complaint of pain, but lay constantly on the side opposite to that which was wounded, was inclined to sleep, and when asked a question, spoke slowly, as if in great distress. The wound was in the left side, about two inches above the hip bone, and penetrated into the cavity of the belly, but neither its direction nor depth could be ascertained. He did not seem to have bled much, but was very faint, his body cold, and the pulse scarcely perceptible. The circulation was so languid, that, though a vein was opened in both arms, no blood could be obtained." He soon after his admission into the hospital began to breathe with difficulty, (which at first he had not done.) A great sense of weight was experienced about the chest. He felt some pain in the breast. A swelling next took place, proceeding from the breast all over the body. A little after two o'clock in the morning, (*nine hours after the wound was received,*) a sudden strangulation in the throat put a period to his life.

Upon dissection it was found that the bayonet had penetrated through the integuments, the abdominal muscles and peritoneum, had pierced the colon, the stomach, the left lobe of the liver, the diaphragm, and entered the thorax at its centre. Immediately within the breast the pericardium had presented and yielded the instrument a ready passage to the heart. *The right ventricle there received it.* The point was thrust in at the lower part of the ventricle, and had forced its way out near the valve. From the heart, again passing the pericardium, it pierced through both the upper and middle lobes of the lungs, but even these were insufficient to detain it. It forced a passage on the right side near the sternum, between the cartilages of the second and third ribs, and had sheathed its point beneath the pectoral muscle. That muscle was slightly wounded, but the integuments above it were unhurt. A little bloody serum was found in the cavity of the belly, but scarcely any pure blood. The pericardium contained a little blood. The right side of the breast contained above two quarts of blood, partly in a fluid and partly in a coagulated state.

I have quoted this abridgment of the case, because, although so terrible a wound as that here described must be considered necessarily fatal, yet, during the time the patient lived, a simple puncture of one of the cavities of the heart might have united.

Mr. Pelletan, has lately published a case in which the aorta was punctured by a small sword in a duel. The weapon entered above the right pap, and from his bent posture, passed through his body and out of the left side near the lumbar region. The young man declared the wounds to have been made by the same thrust, (which was doubted at first from the strange course of the sword) and said he had himself pulled it out. The most dangerous consequences were expected, but many days passed without any. He complained of pain in the lumbar region, but the warm bath, two bleedings, and a low diet relieved this, and *he lived two months* after the accident, at which time he expired in great pain, a tumour having formed opposite to the eighth dorsal vertebra. Upon dissection the right side of the chest was found filled with blood coagulated in different degrees. This blood led to *an opening as large as a writing quill*, with which the aorta was pierced, above the crura of the diaphragm. These crura and the surrounding cellular texture were injected with extravasated blood. No viscus of the abdomen or thorax had any mark of injury (the sword having probably passed behind them) and there was no reason to expect *a priori* a wound of the aorta.*

Hemorrhage from wounds of the chest cannot be commanded by ligature, unless it proceeds from an intercostal artery. The intercostal arteries are sometimes wounded, and although not very large, bleed freely. It has been proposed to secure the vessel by passing a ligature round the rib, and tying a piece of lint upon it. As this operation, however, would leave a foreign substance in the cavity of the thorax (a portion of the ligature) much inflammation would result from it; and although I have never seen such a case, I cannot but express my opinion that a safer measure would be to make a free external incision, and secure the vessel in the usual way, pulling it out with a tenaculum which could with common dexterity be performed.

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* *Chinique Chirurgicale*, tom. i. p. 92.

A case of ruptured aorta is described by Mr. Linn, jun. in which the patient survived two weeks. *Medical Records.*

Wounds of the larger vessels of the lungs generally terminate the existence of the patient in a few minutes. If the lungs be wounded, without injury to any of the great vessels, abscesses frequently form in the chest, attended with hectic fever, night sweats, great exhaustion, diarrhœa, and eventually death. In some cases, however, bullets and also small swords, have passed through the chest, and still the patients have recovered.

Mr. Hunter remarks, "it is pretty well known that wounds of the lungs (abstracted from other mischief) are not mortal. I have seen several cases where the patient has got well after being shot quite through the body and lungs, while from a very small wound made by a sword or bayonet into the lungs the patients have died, from which I should readily suppose that a wound in the lungs from a ball would in general do better than a wound in the same part with a pointed instrument, and this difference in effects would in many cases appear to arise from the difference in the quantity of blood extravasated, because the bleeding from a ball is very inconsiderable in comparison with that from a cut, and there is therefore a less chance of extravasated blood, either in the cavity of the thorax or the cells of the lungs. Another circumstance that favours the gunshot wounds in these parts is, that they seldom heal up externally by the first intention, on account of the slough, especially at the wound made by the entrance of the ball, so that the external wound remains open a considerable time, by which means any extravasated matter may escape; but even this has often its disadvantages, for by keeping open the external wound which leads into the cavity, we give a chance to produce the suppurative inflammation through the whole surface of that cavity, which would most probably prove fatal."

When the quantity of blood poured out into the cavity of the pleura is small, if it do not readily escape at the external wound, the absorbents take it up; but if the wounded lung continue to bleed into the cavity of the pleura, symptoms of an alarming kind are produced. Great prostration of strength, which proceeds from the nature of the parts wounded, and perhaps a fainting from the quantity of blood lost to the circulation. A great heaviness will be felt in the breast, and considerable difficulty of breathing. The causes of this difficult respiration will be the pain which the patient will have in expanding the lungs in inspiration; the injury of some of those muscles which move the ribs; and also the diminution of the capacity of the thorax, from the effusion of blood into the cavity of the pleura which prevents the complete expansion of the lungs.

The patient will not be able to lie down, but must sit upright, because this posture throws the weight of the effused blood upon the diaphragm and forcing this downwards, somewhat enlarges the thorax. Wherever a large extravasation of blood into the cavity of the pleura exists, an opening for its evacuation must be made, and this should be done if possible before it coagulates, in order that it may the more readily escape through a small wound.

In some cases it may be convenient to enlarge the original wound, but it is often necessary to make a new opening, which may be done with a scalpel, just above the upper edge of any of the ribs. If a small opening suffice to evacuate all the blood, it will be more apt to heal by the first intention, but if the blood be found coagulated, a larger aperture will be necessary. When the contents are evacuated the wound must be accurately closed with adhesive plaster.

Sabatier takes notice that many writers recommend this operation, but that very few have performed it. He relates, however, one case in which it became necessary from a bleeding from the internal mammary artery after a gunshot wound. Mr. Saucerotte performed it, and his patient recovered.*

The treatment of gunshot wounds penetrating the thorax, is to be extremely simple; superficial dressings are to be applied, a soft poultice enclosed in a bag of gauze or muslin, or a pledgit of linen rag spread with simple cerate may be used. Great care is necessary to prevent the dressing from being drawn into the chest during inspiration, as much irritation would be the consequence of any foreign substance being introduced into the cavity of the chest.

Gunshot wounds through the chest, when the sloughs separate, leave very considerable openings into the cavity of the pleura, and although it is a fact that these wounds are less generally fatal than stabs with sharp instruments, from their bleeding less freely, yet they are much more complicated, and often attended with fractures of the ribs, and with extraneous matter in the thorax, as the clothing of the patient and the ball. They are followed by tedious exfoliations of the ribs; by long continued suppurations and hectic fever, which however are not always fatal. In some instances the suppuration takes place from the whole cavity of the pleura, and immense quantities of pus are discharged. In some the lung gradually wastes away, and nothing remains of it but a hard diminutive tubercle at its root.

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* *Medicine Operatoire.*

"When a man is shot through the lungs, if death be very near, it must be from suffocation, and you will find him with a bloody foam at his mouth, his face pale at the cheeks, and livid round the lips and eyes, heaving the breast with intolerable anguish, tossing from side to side in bed, the bloody foam increasing, the breathing becoming more difficult, and the blood and air rattling in the throat; then the pulse flutters, and the extremities continually grow colder, till struggling in something like a convulsion he expires." JOHN BELL.

In this manner soldiers frequently perish on the field of battle, their cases admitting of no relief. But many cases, as we have already stated, do admit of relief, and as the primary danger depends on suffocation from the air cells of the lungs being filled with blood, the remedy must be an immediate evacuation of blood by venæsection, and this is to be carried to a greater length than in almost any other accident or disease, first with a view to unload the lungs and prevent suffocation, and afterwards to prevent and cure the succeeding inflammation. The French surgeons have been famous for the quantities of blood which they direct to be drawn in such cases. They have been censured for it, but I believe with Mr. John Bell, that it is hardly possible to carry the practice too far. Sabatier relates a successful case in which the patient was bled twenty-six times, and I have myself known a young man to lose one hundred and eighty ounces of blood in twelve days, in consequence of a gunshot wound in the chest. He recovered rapidly, although a very large opening had been made by a load of small shot.

In some cases EMPHYSEMA occurs from wounds of the lungs. It commonly happens from the wound being of small size, and not entering in a direct line. "It is less frequent in large wounds with a knife or broad sword, because there the air has an open and unimpeded issue;" and "more frequent in deep stabs with the bayonet or small sword;" and "it is peculiarly frequent in gunshot wounds, because the orifice in the skin inflames and swells while the wound is wider within."

This singular affection consists in an escape of air from the lung into the cavity of the pleura, and from thence into the cellular texture over the wound, its escape being prevented by a closure of the external opening, the wound through the skin not corresponding with that in the pleura; sometimes it occurs without the lung being wounded from the air which entered the thorax by the external wound. In common it confines itself to the vicinity of the wound, but sometimes it extends very rapidly, swells the whole figure, closes the eyelids, obliterates every appearance of the neck, which has the same diameter as the trunk. The extent to which the body swells in emphysema may be judged of from a case related by Mr. Littre in the Memoirs of the French Academy, in which the skin over the chest was distended to the distance of eleven inches from the ribs. The palms of the hand and soles of the feet are the only parts which do not partake of the tumefaction.

The treatment consists in making punctures through the skin with a lancet opposite to the wound in the thorax, by which the air may be allowed to escape. If small punctures through the skin be found ineffectual, a free incision is to be made into the thorax, through the skin and muscles, which puts an immediate stop to the progress of the complaint, care being taken to avoid the intercostal artery.

In many instances it is not easy to ascertain whether the difficulty of respiration depends upon air or blood confined in the pleura. The incision is equally effectual in both cases. It is not by compressing the lung of the wounded side that the oppression is occasioned, for this lung must be in a collapsed state from the moment when the air was admitted into the thorax, and of course respiration is entirely performed by the opposite lung. The oppression proceeds from the pressure of air or blood upon this sound lung, its freedom of motion being thereby impeded.

A protrusion of a portion of the lung through a wound of the chest is an accident which has sometimes occurred. Sabatier recites several cases, and in some the surgeons appear to have treated the patient very roughly, having cut off the protruded lung with a hot iron in one instance, and applied stiptic powders after cutting it off, in another.* Notwithstanding these harsh proceedings the patients got well.

The proper plan, if we are called before the protruded piece of lung is mortified, will be to replace it without delay; and if necessary the wound may be enlarged to facilitate its reduction. After this the usual dressings are to be applied. If mortification have taken place, Sabatier recommends the application of a ligature round the part to prevent hemorrhage, and the excision of the mortified portion, a practice which I think ought never to be followed, because, if the ligature be applied tight enough to command the hemorrhage, it will infallibly produce gangrene and slough off; now the mortified part will as certainly separate without the ligature, and ought therefore in every case to be left. Until this separation happens, it will be safest to leave the mortified portion outside, because adhesions will form connecting the lung to the margin of the wound, so that when the separation of the slough takes place, the cavity of the thorax will not be exposed, whereas if a portion of mortified lung be returned into this cavity and there separate, it will undoubtedly occasion as great inflammation as other foreign matter, and render it necessary to keep open the external wound.

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* *Médicine Opératoire*, tom. ii. p. 272.

When foreign substances, as fractured bone, pieces of cloth, &c. are lodged in the thorax, they must if practicable, be immediately removed. Pieces of the rib are frequently broken off in such a manner as to project inward and irritate the lungs. In this case a pair of forceps must be introduced, and the splinter separated. A musket ball sometimes lodges in or about the thorax, and, in general, it is "irrecoverably lost;" but the clothing carried in with it may commonly be found, and should be then carefully extracted, for every thing of this kind has a tendency, like the setons of the French surgeons, to keep up inflammation and suppuration. I was called to visit a carpenter wounded in the back by falling on a chisel; the wound penetrated into the chest, and as the muscular flesh through which the chisel had passed bled freely, an old lady emptied her snuff box into the wound. At every inspiration some of the snuff entered into the thorax, and the consequence was a general suppuration from the cavity of the pleura, exposing the life of the patient to great hazard.

Care should be taken to extract every foreign body within our reach, and to prevent our dressings, &c. from being drawn into the chest.

CHAPTER XV.

Wounds penetrating the Abdomen.

In consequence of the great variety and importance of the viscera contained within the abdomen, wounds penetrating this cavity must differ essentially in their nature and consequences according to the parts injured.

In a wound through the parietes of the abdomen, in which none of these viscera are implicated, the great object of the surgeon is to produce a speedy union of the wound, in order to prevent the inflammation of the peritoneum. There is no reason for believing that this inflammation arises from the admission of air into the cavity,* neither is the diminution of its temperature the cause,† as the application of ice in cases of hernia frequently reduces the heat of the abdomen much below that of the atmosphere, without any such effect, and peritoneal inflammation is as apt to occur in the hottest summer weather when the thermometer rises nearly to the heat of the blood, as in the depth of winter. The real cause of this inflammation in wounded cavities, it is by no means easy to ascertain, it is much easier to ascertain that none of the alleged causes can explain it. The fact is all we have to state. Whenever a large cavity, as the thorax, abdomen, or a large joint, is cut open, unless the wound be promptly healed, violent inflammation occurs throughout the surface of that cavity. The imperfection of the cavity appears to be the only circumstance necessary to the production of this inflammation, but how it effects it I am not prepared to say.

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* The cavity of the abdomen is a plenum, every part of it occupied with something, and no space exists for the admission of air. Into the thorax, when wounded, air finds a ready entrance, but not so in wounds of the abdomen.

† This opinion has been maintained by Dr. James Cocke in his Inaugural Essay, published in this city in 1804.

If the wound be made by a sharp instrument, it is to be closed by the interrupted suture, care being taken to pass the needle from within outwards, about half an inch from the wound; it is most readily effected by having a needle at each end of the ligature; none of the strings are to be tied until all the stitches are made.* In this case I should not use leather ligatures. The various antiphlogistic remedies are to be used in order to prevent inflammation, and also to relieve it, if it supervene.

It is always of extreme importance to ascertain whether any of the viscera of the abdomen be injured, because the danger of the case, and the remedies to be employed, depend greatly upon this circumstance. If any part of the bowels protrude, it should be examined carefully before it is replaced. If the wound be a small incision or a puncture, it is more difficult to ascertain the extent and nature of the mischief. Some information is to be gained by examining the instrument with which the wound was inflicted, and by observing how much of it had entered, and in what direction. If a large quantity of blood escape at the wound, there is reason to apprehend the injury of some of the viscera (unless the wound be in the course of the epigastric artery.) If bile, fœces, or any of the usual contents of the viscera, make their appearance, there can be no doubt of a wound in an intestine. Very little is to be learned by examinations with probes, or even by passing the finger into the wound, and therefore unless some real good can result from it, it should be omitted.

When a large blood-vessel is opened, and the blood does not find a ready exit through the external wound, great debility comes on, fainting, a weak faultering pulse, cold sweats, swelling of the abdomen, and, if the bleeding should not stop, death.

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* Adhesive plaster is also to be used, and over it a compress and bandage.

Gunshot wounds of the abdomen in general occasion complicated mischief, the ball passing through the viscera, and wounding them in several places. If the ball pass with considerable velocity, sloughs must take place, and greatly enlarge the various openings it has made. "If the ball pass with less velocity, there will be less sloughing, and the parts will in some degree heal by the first intention similar to those made by a cutting instrument; but although the ball has passed with such velocity as to produce a slough, yet that wound shall do well, for the adhesive inflammation will take place on the peritoneum all round the wound, which will *exclude the general cavity from taking part in the inflammation*, although the ball has not only penetrated, but has wounded parts which are not immediately essential to life, such as the epiploon, mesentery, &c. and perhaps gone quite through the body; yet it is to be observed that wherever there is a wound, and whatever solid viscus may be penetrated, the surfaces in contact, surrounding every orifice, will unite by the adhesive inflammation, so as to exclude entirely the general cavity, by which means there is *one continued canal, wherever the ball or instrument has passed;* or if any extraneous body should have been carried in, such as clothes, &c. they will be included in these adhesions, and both these and the slough will be conducted to the external surface by either orifice."

This quotation from Mr. Hunter explains the reason why so many patients get well of wounds in the viscera, and affords a wonderful proof of the resources of nature, in providing against danger and death. Unless adhesive inflammation arise and agglutinate the injured bowels together, at the circumference of every aperture made into them, death must inevitably result, from the escape of the contents of these viscera into the general cavity of the abdomen.

From this view of the subject, and from repeated experience, we learn that most of the viscera of the abdomen may be wounded without fatal consequences. The gall bladder is perhaps an exception, because the acrid nature of its contents, and the facility with which the bile escapes whenever this viscus is punctured, cannot fail to occasion peritoneal inflammation; and we find no case recorded of a recovery after a wound penetrating the gall bladder. If any acrid substance escape from the stomach into the general cavity of the belly, as ardent spirit, &c. the same fatal consequences will result, of which I once saw a striking instance in a man whose stomach was wounded after drinking porter. The wound of the stomach was found on dissection completely healed; the patient died on the fourth day of peritoneal inflammation.

The inflammation of the cavity of the belly which occurs whether the viscera be wounded or not, (unless the external wound be promptly united) calls for copious and active measures; bleeding, purging, low diet and blisters, over the abdomen. In general these remedies, if commenced early, and pursued actively, are found successful, and the inflammatory symptoms subside. In others it terminates in adhesions, connecting together the different viscera, coagulating lymph being poured out, on various parts of the peritoneal surface. In others suppuration takes place, and large quantities of matter are formed in the abdomen. Mortification also sometimes occurs, and consequently death.

If the remedies for inflammation do not succeed in reducing it, and suppuration takes place, when its existence is clearly ascertained, a lancet may be introduced, and afterwards a canula through which this matter may be evacuated. If no particular spot appear elevated more than the rest, the puncture may be made at the usual place where tapping for dropsy is performed, about two inches below the umbilicus.

In some wounds of the abdomen a protrusion of some of the abdominal viscera takes place; where the protruded parts are uninjured, it is always best to replace them as speedily as possible within the cavity. If they be wounded, or if from long exposure and the stricture made upon them by the wound, they are in a mortified state, other measures are necessary. Previously to replacing them all extraneous matter should be carefully removed. Dirt, clots of blood, and every foreign substance, must be washed off with warm water. I have seen a large portion of the colon, together with the omentum covered with sand and dirt mixed with blood, protruding from a large wound in the abdomen; great care was in this instance necessary to prevent the introduction of these irritating matters into the abdomen.

It often happens that a considerable stricture is made upon the protruded parts, and of course difficulty is experienced in reducing them. To facilitate it, the patient should be placed in such a posture as to relax the muscles of the abdomen. If the difficulty arise from distention with fœces or flatus, the contents may often be squeezed out, and the bulk of the intestine thus reduced. If, however, the reduction be still difficult, it is highly improper to use any violence in attempting it; it is better to enlarge very carefully the wound with a bistoury.

The treatment of the case when a portion of the intestine is mortified, will be described in the chapter on hernia, as it forms a very important variety of that complaint.

Blood is sometimes poured out in considerable quantities by some large vessel within the abdomen. If the quantity be very great, swooning, and the usual debilitating effects of hemorrhage quickly ensue. If the patient survive these symptoms, the collection of blood is easily perceived forming a tumour in some part of the abdomen. The abdominal viscera are so closely in contact that a general diffusion of this blood among them seldom happens; it is found, on the contrary, collected into one spot; and this, according to Sabatier, is in the lower and anterior part of the abdomen, just above the pubis.* He remarks that, in general, upon opening bodies in which these extravasations have happened, the blood is found in every part of the cavity, but that this is entirely owing to carelessness in the dissection, and that a cautious proceeding discovers that it is collected in one mass, and that after a time it becomes firmly surrounded by the matter of adhesions, in consequence of inflammation, forming a kind of sac or pouch.

The changes which the extravasated blood undergoes, coagulating and irritating the surrounding parts, occasion very distressing symptoms. In the first place pain, and tension of the part, followed by hiccough, costiveness, vomiting, and sometimes suppression of urine. Sometimes by great weakness, a small feeble pulse, and cold sweats.

To relieve these symptoms, it becomes necessary to make an opening for the discharge of the blood. A puncture is to be made with a lancet, or trochar, and a canula introduced; if the blood be fluid it will readily flow through it; when it is found coagulated, it has been recommended to inject warm water into the wound, in order to wash it out; from the fact that injections of warm water in cases of hydrocele, effect a radical cure by exciting inflammation, I have strong doubts of the propriety of this practice.

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* *Médecine Opératoire*, tom. i. p. 35.

When the contents of the viscera are extravasated, the only remedies which can be employed are the remedies for inflammation; rest, a low diet, bleeding, purging, &c. They sometimes form abscesses, and are discharged externally. I have known a piece of cheese which escaped from a wounded stomach, discharged after the wound had healed, by an abscess in the groin.

WOUNDS OF THE ABDOMINAL VISCERA.

The symptoms denoting wounds of the particular viscera of the abdomen are not always strongly marked, but in general we are able, from a careful investigation to ascertain with some degree of accuracy the parts injured.

"From a wound in the liver there will be a pain in the part of the sickly or depressing kind; and if it is in the right lobe there will be a delusive pain in the right shoulder, or in the left shoulder from a wound in the left lobe.

"A wound in the stomach will produce great sickness and vomiting of blood, and sometimes a delirium.

"Blood in the stools will arise from a wound in the intestine, and according to the intestine wounded it will be more or less pure; if the blood is from a high part of an intestine, it will be mixed with fœces and of a dark colour; if low as the colon, the blood will be less mixed and give the tinge of blood; and the pain or sensation will be more or less acute, according to the intestine wounded, more of the sickly pain the higher the intestine, and more acute the lower.

"There will be bloody urine from a wound of the kidneys or bladder, and if made by a shot or ball and a lodgment made, these bodies will sometimes become the cause of a stone. The sensation will be trifling.

"A wound of the spleen will produce no particular symptoms, excepting probably sickness, from its connexion with the nerves of the stomach." (HUNTER.)

In the treatment of wounds in the stomach or intestines it must be evident that many cases occur where the part wounded cannot be exposed, or indeed known, and here nothing is to be done but to combat the inflammatory symptoms.* When a wound in the stomach can be seen, a number of stitches proportioned to its extent must be used, the ligatures cut off close, and the parts returned. In transverse wounds of the intestine, in which the greater part of the canal remains entire, the experiments of Mr. Astly Cooper and other surgeons have proved the safety of closing the wound by the interrupted suture, and returning the gut into the belly. The stitches are separated by the actions of the absorbents, and pass readily through the intestinal canal, a coating of coagulating lymph being formed over them, which prevents their falling into the cavity of the peritoneum, and exciting inflammation there. A single stitch is generally sufficient to close a wound not extending more than half round the intestine, and it should be made with a common round sewing needle armed with waxed thread. Longitudinal wounds of the intestine, it has been believed, do not heal so readily as those which are transverse. There is probably more danger of the escape of fœces from them, and they are not so readily closed. From some experiments of Dr. T. Smith, performed in this city, and published in his inaugural thesis in 1805, it appears that in dogs even extensive longitudinal wounds may be reunited.

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* The propriety of dilating the external wound to search for the wounded intestine is very doubtful; 1st, from the danger attending an enlargement of the wound, and 2dly, from the uncertainty of finding the injured viscus.

It is proper in many such cases to cut out completely the wounded portion and unite the cut extremities together, because the longitudinal is thus converted into a transverse wound.

When the intestine is cut completely through, either by a removal of a mortified portion, or by the original wound, the divided extremities are to be secured by four stitches; the ligatures are to be left out at the external wound, and in a short time they unite, and an adhesion takes place connecting the intestine to the peritoneum at the wounded part. After five or six days, the threads, if loose, may be removed, as they become useless after adhesions take place. The practice of Mr. John Bell in these cases, of trusting to a single stitch, is full of danger, and ought never to be adopted. Mr. Cooper's remarks on the treatment of mortified intestine in his work on hernia are entirely applicable to the present subject.

In most instances of wounded intestine the canal is diminished at the injured part, and cholicky pains are an occasional consequence. A great degree of constriction has in some cases resulted and terminated fatally, but in general the bowel regains its usual volume, and performs its functions as well as before the injury.

In all cases where there is reason to believe that the bowels are wounded, it is important to prohibit the use of solid food, and confine the patient to barley water exclusively, or some mild drink.

Wounds of the OMENTUM or mesentery seldom occasion trouble, except from their bleeding; when practicable, the bleeding vessels are to be secured by ligature, and the ligature in every instance left out at the external wound.

Wounds of the GALL BLADDER are, in the opinion of most surgeons, necessarily fatal. A case is related in the Edinburgh Medical Essays, in which the patient survived this accident a week. Before death the abdomen became extremely tense; a rumbling noise was heard in it. The patient had no stools, notwithstanding the use of purgatives and glisters. Sleep could not be procured, although anodynes were exhibited. No fever appeared. The pulse was natural till the last day, when it became intermittent. Upon dissection the intestines were found much distended, the gall bladder quite empty, and a large quantity of bile, extravasated in the abdomen. Sabatier relates a case in which bile was drawn off by a trochar from the cavity of the belly; but no advantage resulted, and the patient died a few hours after it was performed, viz. on the third day.

Wounds of the LIVER call for no particular treatment. They are generally, when extensive, fatal from hemorrhage, owing to its great vascularity; and if any of the branches of its excretory duct are punctured, the bile escapes and occasions inflammation of the peritoneum. Small incised wounds of the liver often heal without difficulty.

Wounds of the KIDNEYS are not fatal unless the urine escapes into the cavity of the abdomen. They call for no particular treatment. The patient generally voids bloody urine at first, but the part soon heals.

CHAPTER XVI.

Wounds of Joints.

IN these, as in other wounds penetrating cavities, it is of great importance to guard against inflammation, as the effects of violent inflammation in the larger joints, upon the constitution are very serious.

In all cases of wounded joints it is important to place the limb in such a posture as to favour the approximation of the sides of the wound. Absolute rest is to be enjoined, and a rigid adherence to the antiphlogistic treatment. Sutures are never to be used in these cases, if it be possible to dispense with them, and when it is not, they must never be passed into the cavity of the joint, but only through the cellular membrane on the outside of it, for very obvious reasons. Treated in this manner, incised wounds of the larger joints very readily heal by the first intention, even when the articulating extremity of the bones are injured.

When inflammation supervenes in consequence of a wound in a large joint, the constitution suffers severely: fever comes on, generally ushered in with a great degree of nausea. Violent pain takes place in the joint, and an increased secretion of synovia, which is thinner and more watery than usual. The ligaments swell and become thickened by effusions of coagulating lymph. At length suppuration takes place, and pus is secreted from the whole surface of the synovial membrane; ulceration comes on, and openings are formed in various parts of the skin covering the joint.

The formation of an abscess in a large joint, as the knee or hip, never takes place without great danger to the life of the patient. I have seen death occur in a very few days from inflammation of the knee, terminating in suppuration. Extreme pain, fever and delirium, generally precede the fatal event.

In those cases where the symptoms of inflammation do not terminate so speedily, ulceration of the ligaments is followed by inflammation of the bone; the cartilage is absorbed, and the whole joint destroyed; granulations arise from the inflamed bones; they unite, and anchylosis is effected; but these processes require a great length of time, and during this time the patient is affected with hectic fever, and great exhaustion from the continued discharge. Abscesses also form in the vicinity of the joint, and portions of carious bone or detached cartilage, are evacuated through them. Before anchylosis can in this manner be accomplished, the patient must inevitably suffer a tedious, painful confinement, under which the constitution often sinks, and a lingering death eventually concludes his sufferings.

These terrible consequences sometimes result from simple incisions or punctures into joints, as well as from the more aggravated mischief of lacerated or gunshot wounds. They are only to be prevented by a most active employment of the remedies for inflammation already enumerated.

On the first approach of inflammation, bleeding is to be performed, and carried to as great an extent as the patient's strength will warrant. Topical bleeding, by cupping or leeches, is next to be employed, and after this a blister should be applied large enough to cover the skin over the joint. The blister in these cases should be applied earlier than is recommended by authors. I have seen the best effects from a speedy application of this remedy.

In chronic inflammations of joints, either from wounds or other causes, the repeated use of blisters is never to be omitted. Purging is also to be actively employed.

In order more effectually to procure absolute rest of the joints, it is advantageous in some cases to apply carved splints to fit the parts, and these being lined with soft materials, occasion no inconvenience. In wounds of the knee, ankle or elbow, these splints are particularly useful.

When in consequence of the violence and continuance of the inflammation, there is reason to apprehend a stiff joint from anchylosis, it is necessary to choose the position of the limb, in which this stiffness will be least inconvenient to the patient, and to preserve that posture during the cure. If, for example, the elbow were to heal with the arm permanently extended, the limb would be almost useless, whereas an arm flexed at the elbow, even when the joint allows no motion, is extremely useful. In the lower extremity on the contrary, a flexed posture would preclude the patient from walking, while an extended leg, with a stiff knee, would be attended with comparatively little inconvenience.

Lacerated and gunshot wounds of the joints are always attended with more danger than simple incised wounds, because in them the parts cannot unite so speedily, and the cavity remains longer imperfect. So great is the danger to the life of the patient, that it always becomes a serious question with his surgeon in such wounds of the elbow, knee, or ankle, whether an amputation ought not to be immediately performed. In addition to the dangers already enumerated, gangrene from the disorganization of the parts may occur, or life may be destroyed by tetanus.

It is not easy to give any general rules by which to guide our decision of the momentous question of amputation in wounds of joints. Undoubtedly many cases occur, in which the destruction of the surrounding parts, arteries, nerves, tendons, &c. together with the shattered state of the bones forming the articulation, especially when this complicated injury has occurred in the hot weather of summer, leaves no doubt of the propriety of immediately removing the limb; but other cases occur in which the main artery of the limb is not destroyed, and in which there is a prospect of saving the limb, provided the patient escape the dangers of gangrene, of tetanus, of inflammatory fever, of extensive suppurations, of hectic fever, &c. In cases of this kind the surgeon feels his responsibility to be great, and it requires an attentive consideration of every circumstance connected with the particular case to confirm his decision. All these circumstances should be stated to the patient and his friends, and they should assume the responsibility and conclude whether to attempt the saving of a limb, by incurring the dangers which must be encountered, or by an amputation to avoid them.

The cartilages of a joint never either inflame, suppurate or ulcerate; they are incapable of restoring themselves when injured, and although flesh in some cases grows over them, they never adhere to it. Mr. John Bell observes, "we amputate a toe at the joint, and the flaps unite in two days, but still they have united with each other only, and not with the cartilage at the joint; and in a luxated limb we find that the bone continues displaced, the cartilage never inflames, nor ever unites with the lacerated parts."

CHAPTER XVII.

Wounds of Nerves and Tendons.

In most of the systems of surgery which have been published, WOUNDS OF THE NERVES have been considered as a subject of great importance, and many terrible consequences are attributed to punctures or partial divisions of them.

The first symptom indicating a wound of a considerable nerve is severe pain, and afterwards a numbness, or diminution in the sensation and powers of the part to which the injured nerve was distributed. These symptoms in general gradually subside, and no particularly bad consequence results from the wound.

The inflammatory symptoms sometimes consequent to the operation of phlebotomy have been ascribed by many surgeons to punctures of a nerve or tendon. The true explanation of these effects we shall presently offer.

The operation of cutting down to the nerve and dividing it entirely, is very seldom to be performed. The only case in which it is to be recommended is when after venæsection, the patient experiences violent pain, followed by numbness of the arm, and where these symptoms, instead of subsiding after a few days, increase in severity. Under such circumstances an incision should be made through the wound, and carried a little below it, by which in all probability any partially divided nerve would be completely cut through, and the symptoms, if derived from this source, would speedily cease.

The necessity for this operation is, however, extremely rare. I have never seen or heard of a case in this city (where blood-letting is a very frequent operation) in which the symptoms have been such as to warrant any surgical operation for the division of a nerve.

TENDONS, when wounded, occasion no pain. There are many proofs that tendons in a healthy state possess little or no sensibility; when inflamed, they are often exquisitely sensible. It occasionally happens, however, in punctured wounds, that certain tendinous fasciæ are pierced, and the soft parts below the expansion are also injured; when these inflame, the stricture formed by the tendon occasions very severe pain, and greatly aggravates the inflammatory symptoms. In these cases a division of the tendinous fasciæ procures immediate relief. As the fasciæ attached to the tendon of the biceps flexor cubiti is situated in the vicinity of those veins from which blood is generally drawn, there is reason to believe that in some rare cases this accident has happened in phlebotomy; in such cases a small incision through the fasciæ could very readily be made.

Wounds of tendons are to be treated as wounds in other parts, by keeping them at rest with their divided surfaces in contact. It happens to carpenters and ship joiners, occasionally to divide with a foot adze the tendo Achillis. When this accident happens, the foot is to be kept extended by a splint secured by means of a roller in front of the leg, extending from just below the knee to the point of the toe; compresses being applied to fill up the inequalities of the limb, the divided surfaces of the tendon are to be accurately placed in contact, and kept so six or eight weeks, when union will be effected; but several months must elapse before the patient attempts to support the weight of the body upon this tendon. The same mode of treatment is to be used in ruptures of the tendon. In wounds, however, the skin is apt to fall into folds, and insinuate itself between the cut surfaces of the tendon. To prevent this inconvenience, adhesive plaster should be applied in such a manner as to keep it pulled back from the wound.

Dr. Monro's plan of dressing such an accident is equally successful. It consists in having a strap fastened to the heel of a slipper, and this strap buckled to a bandage fixed round the leg just below the knee. The roller on the leg prevents the action of the gastrocnemii muscles, by which the superior portion of the tendon would be pulled up, and the strap on the slipper keeps the foot in an extended position, by which the lower portion is prevented from being drawn down.*

WOUNDS OF VEINS.†

These generally occasion very little trouble; the hemorrhage may be commonly stopped by compression. In some cases, however, the cavities of veins, like the other cavities of the body, take on inflammation, in consequence of the external opening not being united by the first intention. Mr. Hunter has published a very valuable paper on the inflammation of veins in the Medico-Chirurgical Transactions; from this paper it appears that the swelling of the arm consequent to venæsection is generally occasioned by the inflammation of the inner coat of the vein. He has dissected the arm in some cases where patients have died from this disease, and has found in some parts of the vein adhesion, in others suppuration, and in other cases ulceration.

In most cases when pus forms in a vein thus circumstanced, adhesive inflammation having preceded the suppurative stage, is found to have cut off all communication between the general circulation and the inflamed vein. In other cases, however, the pus is not thus excluded from the mass of blood, but is carried along with it to the heart, and occasions death.

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* An accident of frequent occurrence, is a rupture of some muscular or tendinous fibres of the gastrocnemius muscle, attended with severe pain, ecchymosis and subsequent inflammation; the treatment is the same, but patients rarely submit to the confinement, in which case a tight roller applied so as to cover the leg affords great relief, and generally effects a cure. A paper on this subject may be seen in the 7th vol. of the Medico-Chirurgical Transactions by Mr. Wardrop.—The author having tried his plan of treatment was compelled to lay it aside as inefficient; the roller being the only useful part of it.

† The principal circumstances demanding attention in cases of WOUNDS OF THE ARTERIES have been already noticed in the chapter on hemorrhage.

After an abscess is formed by adhesions closing up a portion of the vein, absorption takes place, and the coats of the vein are removed. The abscess then points, and matter appears under the cuticle. Mr. Hunter has seen instances of pus contained in the cavities of veins in many patients who have died after amputation, compound fracture, and mortification. It happens as frequently in healthy constitutions as in others, a proof of which is that if a patient with an inflamed vein be bled in the other arm, the wound heals without any such consequence.

In some cases a considerable portion of the vein takes on inflammation; generally that portion between the wound and the heart, but sometimes the portion next the extremity; a string of abscesses existing throughout its extent. When the parts get well, it is found that the cavity of the vein at the inflamed part has been obliterated, and the patient can never afterwards be bled in that place.

Inflammation of a vein is sometimes an effect after bleeding horses, which is usually done in the neck. "The operator on this animal does not always take sufficient care to close up the external wound, for although the method usually employed would at first sight appear a good one, that is by a pin passed through the wound from side to side, as in the hare-lip, and overtied by a thread or hair; yet if not executed with sufficient attention, I am inclined to believe that it is the very worst, as it very readily promotes inflammation in the cavity of the vein, either of the adhesive or suppurative kind, according as the ligature does or does not communicate with the cavity." (HUNTER.)

Mr. Hunter has seen in some of these inflammations of horses the jugular vein inflamed through its whole length, the head greatly swelled, and the inflammation carried along the vein quite into the chest. Many horses die of this disease, but what is the particular circumstance which occasions their death is not ascertained. "It may be either that the inflammation extends itself to the heart or that the matter secreted from the inside of the vein passes along that tube in considerable quantity to the heart, and mixes with the blood."

In many instances the constitution is affected with violent fever, and in some cases in the human subject death has resulted. Pus passing into the circulation adds, in Mr. Hunter's opinion, to the general disorder, and renders it fatal.

"Although the operation, which is the most frequent cause of this complaint, is in appearance trifling, yet, as it is very often of serious consequence both to the life of the patient and the character of the surgeon, it requires particular attention in the operator to prevent as much as possible an evil of such magnitude; with this view he will be particularly attentive to the mode of closing the wound and binding up the arm: this is to be done by bringing the two sides of the wound together, that they may unite by the first intention. To accomplish this let the surgeon with the thumb of that hand which holds the arm push the skin towards the orifice, while he draws it on the other side to the same point with the compress; thus the skin will be thrown into folds at the wound, over which he is immediately to apply the compress, which should be broad to keep the skin better together, and thick to make the compression more certain."

Mr. Hunter recommends a "compress of linen or lint, in preference to sticking plaster, for the blood drying over the orifice is a kind of bond of union more natural and effectual than any other application, and this conclusion is drawn from practice," more sore arms being a consequence of bleeding where plasters have been used than when the arm has been dressed in any other way.

"When inflammation takes place beyond the orifice, so as to alarm the surgeon, he should immediately make a compress upon the vein at the inflamed part, to make the two sides adhere together; or if they do not adhere, yet simple contact will be sufficient to prevent suppuration in this part; or if inflammation has gone so far as to make the surgeon suspect that suppuration has taken place, then the compress must be put upon that part of the vein just above the suppuration."

The remedy for inflammation of the veins consequent to venæsection, which answers best, is the application of a blister over the inflamed part. As soon as the inflammation commences, a small plaster of simple cerate, spread on linen, should be applied on the orifice, and over this a blister large enough to cover the whole inflamed part, extending three or four inches from the orifice in every direction. This remedy, I believe, was first introduced by Dr. Physick. It has been used by him for many years with constant success, and I have myself employed it repeatedly, and never without advantage.

Should fever attend, purging and low diet should be ordered, and bleeding, if the inflammatory symptoms run high. A splint is sometimes useful to keep the arm at rest.

The inflammation of a vein consequent to venæsection sometimes assumes a chronic form, and continues with a hard swelling and some pain for many weeks. Repeated blisters have been found extremely serviceable in these cases.

It is unnecessary particularly to describe the appearance of the inflamed arm consequent to venæsection, because it is generally known to medical men. In its commencement it resembles somewhat an erysipelatous affection, extending above and below the orifice made by the lancet, a tumor existing, however, at the part which is hard and painful; the arm cannot be bent or extended without great pain. In this state the blister very generally prevents the further progress of the inflammation.

CHAPTER XVIII.

Of Fractures.

A FRACTURE is a breach in a bone, (or as it is generally defined, a solution of continuity) produced by external violence, or by muscular action, or by the conjoint operation of both.

The bones most frequently broken are those of the extremities. Bones are broken in one or in several places; when broken in more than one place, the fracture is said to be comminuted.

Fractures may occur in the vicinity of joints, or in the middle of the bones of an extremity. In the fore arm and leg, one or both bones may be fractured. The fracture may be directly across the bone in a *transverse* direction, or it may be *oblique*, and the degree of obliquity may vary very much.

Fractures differ in relation to the form of the bone, its importance, and uses. The broad flat bones, as the scapula or ilium, are rarely fractured. The bones of the scull, however, are more frequently broken than any other flat bones, and the importance of this accident transcends that of most others, from the effects of the injury upon the brain. The long bones are by far the most frequently fractured.

When the long bones are broken, the place of fracture is a subject of some importance to be attended to in judging of the effects of the accident and of the mode of treatment. In a fracture of the middle of a bone, the broken surfaces are less extensive, and therefore they move more widely one from the other, yet this kind of fracture is the least dangerous, because in such cases the cause is seldom applied to the part fractured, and for that reason the surrounding soft parts are injured equally seldom. A less force suffices to break the bone in its middle than at any other part. It is also certain that inflammation, stiffness, and anchylosis are less likely to happen than when the bone is fractured near the articulation.

Bones are sometimes broken within a joint; the fractured patella is always an example of this. I have seen a fracture through the head of the thigh bone, and also through the head of the humerus.

The relative situation of the fractured extremities it is of great importance to ascertain. In some cases of transverse fracture no derangement at all takes place, the parts supporting each other as though they were not fractured. I had one patient with a transverse fracture of the tibia, who could stand up and bear some of the weight of his body upon the injured leg; and Dr. Physick had a patient who, although the grating of the bones was distinctly heard, before his limb was dressed, took off all the bandages and splints, under an idea that the doctor was mistaken. After walking, however, once or twice over the floor, and being confirmed in his opinion, an unwary motion of his leg occasioned a twist, and it bent under him at the place of fracture. Sometimes the fragments in a transverse fracture are partially separated, and in the tibia we often find one fragment projecting a quarter of an inch or more above the other, and yet a great part of the fractured surfaces remain in contact. This is less apt to happen when both bones of the leg or fore arm are broken, as in these cases a total separation and distortion of the limb generally takes place. In fractures of the thigh and arm the muscles generally draw up the inferior fragment, and thus shorten the limb, even when the fracture is transverse.

In some cases a bone is broken in such a manner as to form an angle at the place of fracture.

The principal causes of the derangement of the fragments are the force which produced the fracture, the weight of the body, or of the fractured limb, and the action of muscles. The force which produced the fracture will often occasion great derangement of the limb, as the kick of a horse. The weight of the arm in fractures of the humerus, and of the leg in fractures of the thigh bone, occasion a separation of the fragments. The weight of the foot, when the patient lies on his back, will occasion a rotation in a broken thigh or leg; but the most powerful of these causes is muscular action.

"Of the muscles which surround a fractured bone some are attached to that bone in a great part of its length, and therefore in many cases to both portions of the fractured bone. Others extend from the bone which is superior to that fractured, to that which articulates with the lower portion, or to the lower fragment itself; there are still others which terminate in the upper fragment, the other extremity of which may be more or less distant. The muscles of the thigh offer examples of these three different dispositions. The triceps is attached to the whole length of the femur; the biceps, semimembranosus and semitendinosus, descend from the pelvis to the leg, to which the lower part of the femur is articulated, and all the movements of which it obeys; the great adductor muscle has its insertion in the lower part of the femur itself; finally the psoas, iliacus, pectineus, &c. descend from the loins and the pelvis, and have their insertion near the superior extremity of the femur.

"The muscles which are attached to both portions of the fractured bone, contribute very little to their change of situation, but may, however, draw them both to the side on which they are inserted, and thus change the direction of the limb. The triceps, and more particularly its middle part, acts thus on the fractured femur, and renders the thigh convex anteriorly. The brachialis anterior tends to produce the same effect when the humerus is broken below its middle part, but the change from the natural situation is principally owing to the muscles which are inserted into the lower portion of the fractured bone, or the limb with which it articulates. Let us suppose the fracture of the humerus between its superior extremity, and the insertion of the great pectoral muscle, this muscle aided by the latissimus dorsi and teres major, draws the inferior portion inward and upward, and causes it to ascend on the interior side of the upper fragment which rests motionless, on account of its shortness, and because the muscles which are inserted into it are not acted on by any cause that excites them to action. In the fracture of the neck of the femur, the superior fragment has no muscles inserted into it, and remains motionless in the articulating cavity; those muscles which, on the contrary, are attached to the lower portion, draw it upward and backward, and render its being displaced in that direction inevitable.

"The lower portion being acted on by the limb to which it is articulated, follows all its motions, and is liable to be displaced by the action of the muscles which are inserted into it. Thus, in fractures of the body of the femur, the biceps, semitendinosus, and other muscles, draw the leg, and with it the inferior portion, upward, inward, and backward, and cause it to ascend on the internal, and a little on the posterior side of the superior portion, the inferior extremity of which projects, in that case, on the anterior and external side.

"In the fracture of the leg, the gastrocnemii muscles, &c. draw the inferior portion upward and backward, with the foot; for in this, as in every similar case, the stronger muscles displace the lower portion of the fractured bone, and draw it in their direction: hence it is, that in this case the portion is drawn backward as well as upward, because the muscles are more numerous and larger on the back part of the leg than on any other. Therefore, when a fracture takes place in any part of a bone, it is easy to determine, from a knowledge of the muscles, what species of derangement will follow, if there be no counteracting cause. Finally, the muscles which have their insertion in a superior fragment, may produce its separation from the inferior. When the femur is fractured immediately below the small trochanter, the iliac and psoas muscles draw forward the inferior extremity of the superior fragment, which raises the skin, and projects more or less. It is to be observed, however, that the displacing of this fragment is very rare, whilst the inferior fragment is displaced in almost every case."—(BOYER.)

Fractures are more or less accompanied with laceration and injury of the surrounding soft parts. When the integuments covering the fractured bone remain entire, even although there be a great degree of laceration underneath it, the fracture is called SIMPLE. A COMPOUND FRACTURE is that in which an external opening is formed, communicating with the space between the broken extremities of the bone, or as it is commonly called, the cavity of the fracture. Mr. Hunter has applied the appellation of COMPOUND SIMPLE fractures to those in which a fracture originally compound becomes simple by the immediate healing of the external wound.

It sometimes happens that fractures are accompanied with dislocation, the dislocation probably in every case preceding the fracture.

The CAUSES of fracture are the endless varieties of accidental force applied to bones. Certain circumstances of constitution, however, may be considered as predisposing causes, such as old age, in which the bones are more brittle than in youth. Any morbid state of the system which occasions absorption of parts of the bony structure. The French surgeons* have recorded cases where bones have been broken by simply turning in bed. Cold weather has been supposed to predispose to fractures. Boyer observes, that if these accidents are more frequent in winter than in summer, it is because persons are then more liable to injuries from falling. Dr. Physick has offered a much more plausible explanation of the fact, which is, that in walking over frozen pavements and other slippery places, great exertions are often made to prevent falling, and this muscular exertion, added to the force of the fall, occasions the fracture. The bones are too well covered to feel much influence from the cold.

The SYMPTOMS of fractures it is very important to be acquainted with. They are severe sudden pain—an alteration in the form of the part—sometimes a shortening of the limb, if the fracture be in an extremity—an inability to move the limb without severe pain at the injured part—an inequality of the skin covering the bone; which renders a fracture of the clavicle, or of the tibia, generally easy to be discovered; crepitation is the most certain of all the symptoms—a grating noise, not to be mistaken for any other sound, which is sometimes very audible. The surgeon should take hold of the limb above and below the fracture, and by moving the fractured extremities of the bone, he produces this noise and decides beyond doubt the existence of the fracture.

If, however, the surgeon be not called till swelling from ecchymosis, and inflammation have come on, it is not easy always to judge whether a fracture exists; in this case he must wait until these symptoms subside.

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* Louis and Saviard.

In judging of the probable event of a fracture, a great variety of circumstances influence the surgeon. The age of the patient is of great consequence; in young persons they heal much more speedily and certainly than in the aged. I have seen several fatal cases of simple fracture in old persons. A healthy constitution, not debilitated by intemperance, is favourable for the healing of broken bones. Drunkards often become delirious and die, in consequence of fractures and other severe accidents. The nature of the accident, the degree of violence applied, and the mode of its application, greatly influence the prognosis. Fractures from gunshot are always dangerous, a portion of bone being destroyed by the force of the ball, which must exfoliate (be separated by the absorbents) before the sound bone can granulate and unite: a *compound* is always more dangerous than a *simple* fracture. A fracture attended with great ecchymosis, and extensive injury of the adjacent flesh, is more dangerous than one unattended with these circumstances. An *oblique* is more difficult to manage than a *transverse* fracture. Fractures of the lower extremities have more serious consequences than those of the upper. In general those of superficial bones are less important than those in which the fracture is covered by large strong muscles. Fractures in the middle of a bone are less dangerous than at its extremities in the vicinity of joints. The season of the year, and many other circumstances, will no doubt affect the healing of broken bones.

The reunion of fractured bones is effected nearly in the same manner as the restoration of soft parts. The inflamed vessels pouring out coagulating lymph, which becomes vascular, and is gradually by a deposition of bony matter and an absorption of the unnecessary parts, converted into a bone.

The uniting medium is called *callus;* it is at first soft, but gradually becomes firmer, and at length completely ossifies.

In some cases the bond of union is very slow in forming, and then the inflammatory action must be increased by stimulating remedies. In other cases too much inflammation exists, and then unless prevented by depletion, suppuration takes place.

OF THE TREATMENT OF FRACTURES.

To place the fragments as nearly as possible in their original position, and to keep them so until union is effected, are the important indications in the treatment of fractures.

To effect the replacement of the fragments, extension and counter-extension are generally necessary, though in some cases, as in fractures of the olecranon and patella, the fragments are to be pushed together. After the parts are placed in their proper position, the application of bandages and splints becomes necessary to retain them so. Extension signifies the force exerted on the fragment of a limb most remote from the body. Counter-extension is the power by which the opposite fragment is prevented from moving with it. The various modes of applying these forces will be most properly considered, when the treatment of particular fractures is described.

The constitutional treatment must be regulated by various circumstances. Inflammation frequently attends a fracture, and is an essential part of the process of restoration. If it be too violent, the surgeon must restrain it by the usual remedies. Purging in many cases of fracture is extremely inconvenient in consequence of the motion to which it gives occasion. Blood-letting is to be preferred, as this mode of evacuation is not liable to any objection, and the bowels are to be kept from costiveness, but no cathartics should be administered, unless in those fractures in which absolute rest is not enjoined, and the patient on the contrary is permitted to walk, as fractures of the arm, clavicle, &c. A low diet should be observed.

When the soft parts are much injured, the antiphlogistic measures are to be carried further than where the only injury is the broken bone. In many cases, by their powerful application, we prevent ulceration which would convert a simple into a compound fracture. In cases of extensive ecchymosis, where no large artery is wounded, cold applications and copious depletion are generally successful in preventing the formation of an abscess.

If any particular artery of considerable magnitude is wounded, it becomes necessary to cut down to it and tie it up; and if possible without cutting into the cavity of fracture.

In every case of fracture in which it is necessary for the patient to remain in bed during the cure (and there are very few in which it is not) a proper bed is an object of great convenience. Sir James Earle has published an account of a bedstead and mattress invented by his son, which in fractures and various other accidents and diseases, adds so greatly to the comforts of the patient, that I think the medical world are under great obligations to the inventor.* In private practice, however, and especially in the country, it is extremely difficult to procure such a convenience, and then a firm common mattress of hair is to be substituted, or if this cannot be obtained, a few blankets folded and applied over boards. A feather

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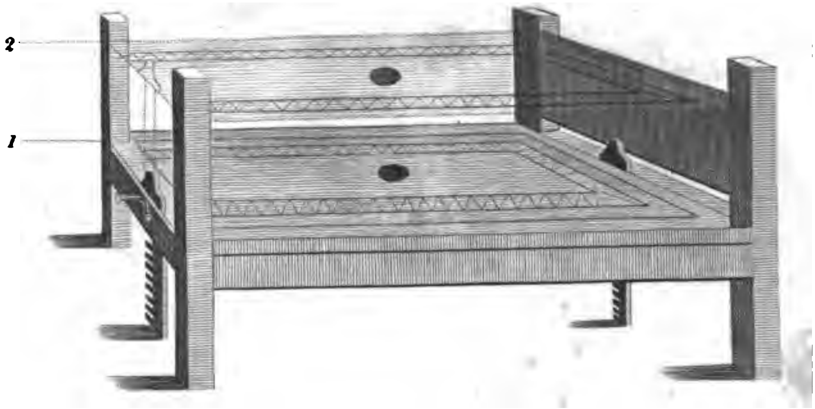
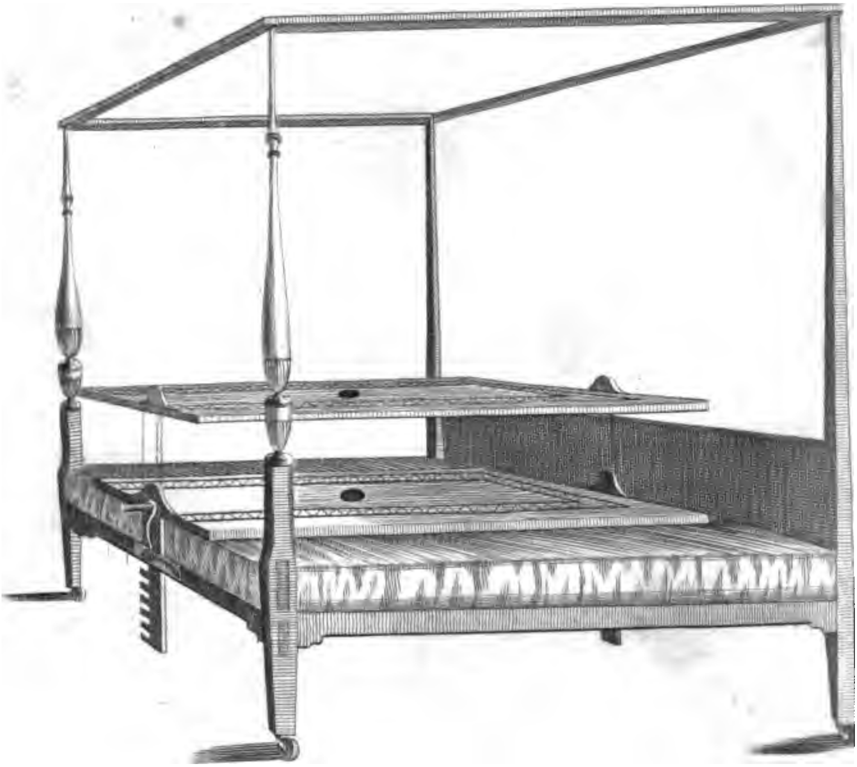
* In the Pennsylvania Hospital, I have constantly used this bed in cases of fracture for several years, and have found it extremely convenient in the treatment of a variety of other accidents. An improvement on this apparatus by Dr. J. R. Barton, is described in the 4th vol. of the Eclectic Repertory.

Earle's Bed.





bed and sacking bottom afford so very unequal and unsteady a surface, that it is extremely difficult to keep the patient who lies on them in a proper posture.

OF COMPOUND FRACTURES.

These have an external wound communicating with the cavity of the fracture. Mr. Pott very judiciously remarks that, "In this kind of case the first object of consideration is, whether the preservation of the fractured limb can, with safety to the patient's life, be attempted; or, in other words, whether the probable chance of destruction, from the nature and circumstances of the accident, is not greater than it would be from the operation of amputation. Many things may occur to make this the case; the bone or bones being broken into many different pieces, and that for a considerable extent, as happens from broad wheels or other heavy bodies passing over, or falling on such limbs, the skin, tendons, muscles, &c. being so torn, lacerated and destroyed, as to render gangrene and mortification the most probable and most immediate consequence; the extremities of the bones forming a joint being crushed, or as it were, comminuted, and the ligaments connecting such bones being torn and spoiled, are, among others, sufficient reasons for proposing and for performing immediate amputation; reasons which, notwithstanding any thing that may have been said to the contrary, long and reiterated experience has approved."

"When a surgeon says that a limb which has just suffered a particular kind of compound fracture ought rather to be immediately cut off than that any attempt should be made for its preservation, he does not mean by so saying that it is absolutely impossible for such a limb to be saved at all events; he is not to be supposed to mean so much in general, though sometimes even that will be obvious; all that he can truly and justly mean is, that from the experience of time it has been found that the attempts to preserve limbs so circumstanced have most frequently been frustrated by the death of the patients in consequence of such injury, and that from the same experience it has been found that the chance of death from amputation is by no means equal to that arising from such kind of fracture.

"Every man knows that apparently desperate cases are sometimes cured, and that limbs so shattered and wounded as to render amputation the only *probable* means, are sometimes saved. This is an uncontroverted fact, but a fact which proves very little against the common opinion, because every man of experience also knows that such escapes are very rare, much too rare to admit of being made precedents, and that the majority of such attempts fail. This consideration relative to amputation is of the more importance, because it requires immediate determination; every minute of delay is in many instances to the patient's disadvantage, and a very short space of time indeed makes all the difference between probable safety and fatality."

It is not easy to give general rules for practice in these cases, or else Mr. Pott, and other writers of great practical experience, would certainly have expressed themselves with more precision. One evades the question, another gives it very little attention, and Boyer (inferior to none in a knowledge of the subject) says, "It is impossible to establish any general rule for cases of this kind. The surgeon must be directed by his own talents and sagacity in each particular case." There are, however, some cases of compound fracture which so evidently call for amputation that no doubt need exist as to the propriety of performing it immediately, if the surgeon is called within a few hours after the accident has happened, and before inflammation has commenced. These are, when a luxation of a large joint, as the knee, ankle, elbow or wrist, accompany the fracture, forming what has been called a compound dislocation; when the principal blood-vessels of the part are destroyed, and thus the danger of gangrene augmented; when a large lacerated wound exists, the bone being greatly comminuted, part of its substance destroyed, and the weather very hot. In such cases, the dangers are to be stated, and the patient and his friends advised to submit to the operation; a mere compound fracture never calls for it; it is the additional injuries which may require so terrible a resource.

Mr. John Bell remarks, "I am sorry to observe this the most important *question* perhaps in surgery, treated as if it were no question, but rather a rule of practice, which might be established on the most absolute grounds. When a surgeon condemns a limb, he does not say that if amputation be not instantly performed the patient will die, nor is he disappointed if the limb be saved; he thinks both more sensibly and more humanely; he knows that there is great danger of losing the patient's life in attempting to save his limb, and reckons it his appointed duty to advise amputation; but he is still sensible that the limb may possibly be saved, and often after his honest opinion is rejected, contributes, by his attention and kindness, to that most desirable object. Sometimes he feels it his duty to advise amputation, and to represent very strongly the manifold dangers of attempting to save the limb, while yet he rejoices to find his patient willing to hazard all those dangers in favour of an object which it must be the chief honour of the surgeon to accomplish."

The wound communicating with the fracture is sometimes made by the protrusion of the bone, at other times by the same force which caused the fracture; the latter cases are generally accompanied with the greatest mischief. If, however, the injury be not so great as to induce amputation, the bone is to be reduced, and proper dressings are to be applied.

Sometimes a considerable portion of bone protrudes through the external wound, and cannot readily be reduced. It has been the custom in these cases to cut off the sharp ends and projecting pieces of bone, but this is almost in every instance unnecessary, and therefore improper. By carefully attending to the posture of the limb, and by dilating the wound when the bone becomes girded in it, and embraced tightly, we may always succeed in the reduction. The enlargement of the wound thus occasioned does much less mischief than violent attempts to reduce the bone, which always occasion bruising and great pain; an incision down upon the bone with a scalpel, or from the bone outward with a narrow bistoury (whichever may in the particular case be found easiest) is to be performed; this incision readily heals, and leaves the wound no larger than it would have been if this had been omitted. Any loose splinters of bone may be removed, and the fragments carefully placed in contact. The wound, if an incision, may be closed with adhesive plaster. Mr. Hunter prefers, however, the application of a superficial dry compress, in order to allow the blood to coagulate and form a kind of scab, shutting up the cavity of the fracture. I have found both methods successful, and prefer the latter in all cases except where the wound of the integuments is somewhat extensive, in which case a strip of adhesive plaster should be applied over the middle of the wound, leaving an opening at each end for the evacuation of effused fluids. We are always to keep in mind the great importance of uniting the wound by the first intention, and thereby converting the accident to the state of a simple fracture, by which much danger and suffering will be prevented. Whatever circumstances, therefore, can keep the parts in a situation favourable for union by the first intention, are to be strictly observed, of course whatever can prevent the inflammatory action from transcending the adhesive grade; copious blood-letting is often necessary in these cases.

In fractures occasioned by gunshot, and in others where union by the first intention is impracticable, and suppuration must take place, from the extensive contusion and injury of the surrounding flesh, a soft poultice of bread and milk should be applied.

The wound being dressed, the accident is to be treated as a simple fracture, and of the proper dressings we shall speak after describing the fractures of particular bones.

When extensive suppurations come on, and exfoliations of bone, the state of the patient's constitution will direct the general remedies. If debility be occasioned, bark and tonics must be administered, and a generous diet with fermented liquors allowed.

The length of time necessary for the reunion of a broken bone varies at different ages and in different bones. In a healthy adult a broken leg will generally heal in six weeks, a broken rib or clavicle in four. In children they heal in a shorter time. In old persons not so soon.

Notwithstanding the use of the proper remedies, cases sometimes occur in which fractures do not heal by forming bone, but by a ligamentous union. The patella generally heals in this manner, and no inconvenience results from a deficiency of bone between the fragments in that particular instance; but whenever this happens in one of the long bones, motion is allowed at the place of fracture, and a joint is formed, which destroys in a great measure the use of the limb, and exposes the patient to great inconvenience. In order to obviate this inconvenience, and to occasion bony union, a variety of measures have been resorted to.

The physiological account of the formation of callus is a subject foreign from our present purpose; it is still, however, necessary to keep in view, that inflammation is essential to the restoration of a fractured bone, as well as of a wounded muscle. Whenever, therefore, two months or more have elapsed, without solid union being effected, it becomes necessary to excite inflammation by rubbing forcibly the fractured ends against each other; after which the dressings are to be re-applied, and the part kept still. If this fail of procuring the desired event (and it sometimes does fail) other measures of a much more active nature become necessary. Mr. Boyer, and other writers who have preceded him, recommend the cutting off of the extremities of the bone, and placing them again in contact. "This operation," he observes, "is painful, terrifying, and of dubious event. Its success, however, has been frequent enough to warrant the trial. It would be impracticable in fractures of the leg or fore arm, on account of the difficulty of separating from the integuments the two bones of which each of these parts is formed, and on account of the numerous nerves and arteries which would be in danger of being wounded by the large incisions, *it is therefore practicable only in the femur and humerus, especially in the latter.*"

Mr. Boyer describes an operation of this kind which he once performed in the middle of the humerus; the limb mortified, and the patient died on the sixth day! In many other cases amputation has been performed. I saw an arm cut off in one of the largest hospitals in Europe in consequence of an "artificial joint" in the middle of the radius. It must be stated, however, that in this case there was a great deal of pain experienced in the part, but I do not consider this by any means an excuse for such an operation, because there is every reason to believe that had the firm reunion of the fragments been effected, this pain would have subsided.

Mr. John Hunter suggested the propriety of exposing the cavity by an incision, under an idea that the "stimulus of imperfection" would excite a sufficiency of inflammation to effect a union of the fragments.

Dr. Physick has the credit of having proposed and practiced a mode of cure in these cases more eligible and successful than any heretofore in use, and one which promises to supersede the cruel and fatal operations which have been mentioned. It consists in passing a seton between the fragments, and suffering it to remain until bony union commences. The first case in which this plan was carried into effect, occurred in the year 1802. The os humeri had been fractured many months before, and a joint was formed in its middle, which rendered the arm useless. A seton needle armed with a skein of silk was passed through the limb (extension being made at the time by two assistants) between the fractured ends of the bone, a pledgit was applied on each orifice made by the needle, which was cut off, leaving the silk in the wound. The operation occasioned very little pain, and the subsequent inflammation was by no means violent, and was followed by moderate suppuration; the arm was in a few days after the operation placed in splints; the dressings were renewed daily *for twelve weeks, during which time no amendment was perceived;* but soon after, the bending of the arm at the fracture was observed to be more difficult, and the patient complained of more pain when it was moved. From this time the bony union went on gradually, and in about five months the cure was completed, leaving the arm as well and strong as it ever had been.

Several cures of the os humeri and tibia have since been made in the same manner. It is important to be recollected that a long continued inflammation must be kept up in these cases, and therefore the seton should not be withdrawn for four or five months unless bony union is found commencing. I am sorry to state that the remedy has been applied to two cases of fractured os femoris without effect; the occasion of the failure was, however, very obvious in both cases: it was found impossible to place the fractured extremities *nearly* together. They had passed each other to a considerable distance, and the adjacent lacerated flesh had healed around them in such a manner, that a great intervention of soft parts existed, and precluded completely all contact of the fragments.* My friend Mr. Brodie of London, has succeeded completely in a case of fractured os femoris, by means of the seton, and believes it applicable to that as to other cases. Mr. Wardrop found it useful in diminishing the mobility of the artificial joint, but the ill health of his patient prevented it from effecting a complete cure. (See Medico-Chirurgical Transactions, vols. 5 and 7.)

It is probable that the remedy will be found effectual in most other cases of artificial joints, but not often in those situated in the os femoris.

Much of the substance of the bone is absorbed in cases of artificial joints, so that the fragments are rounded, or rather pointed, and terminate in a kind of cartilage or ligament.†

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* See plate VI. fig. 6.

† In a thesis published at Paris, by J. B. La Roche, in 1805, the seton, as proposed by Dr. P. S. Physick, is recommended as preferable to all other means heretofore used in such cases; but the writer being unacquainted with the English language, has supposed the family name of Dr. Physick to be that of his profession, and consequently ascribes the honour of the invention to Monsieur P. S. ———, Physician. The writer of the thesis alluded to, having seen setons used after gunshot fractures to facilitate the discharge of dead bone, wonders that the thought never occurred to himself nor his master, of applying the remedy to cure artificial joints.

CHAPTER XIX.

Particular Fractures.

FRACTURES OF THE OSSA NASI.

The ossa nasi, in consequence of their exposed situation, are often fractured. "The cause of the fracture is always applied to that part immediately where the solution of continuity takes place, and the fracture may be oblique, longitudinal, or transverse, without derangement of the fragments; but it more frequently happens that the bones are splintered and crushed into the cavity of the nostril: the nose loses its natural form, and the neighbouring soft parts are much bruised by being crushed between the bones and the cause of the fracture, whether this be a body against which the nose has been forcibly struck, or one which may have been strongly impelled against it.

"If the soft parts have suffered no solution of continuity, and if the fragments have not been displaced, the fracture may not be discovered, because the form of the nose does not change. An oversight in this case is not dangerous, as the use of emollients and resolvents is all that is required. If the fracture be comminutive, not only the inflammatory symptoms ought to be combatted by blood-letting and other antiphlogistic means, but further, the fragments ought to be replaced, as they strain and irritate the soft parts, already contused, by their unnatural situation. For that purpose the surgeon takes a grooved sound, a female catheter, a ringhandled forceps, or any such instrument, introduces it into the nostrils, and by using it as a lever, pushes the fragments outwards; at the same time with the index of the left hand applied to the ringe of the nose, he prevents them from being pushed out too far, and from lacerating the integuments. Sometimes the bones continue in the situation in which they have been thus placed; but it may happen, that from being much fractured, and badly supported by the soft parts, they fall again inwards: in which case a canula of elastic gum should be directed along the inferior surface of each nostril, which ought then to be stuffed with lint, and gently thrust in, lest the pituitary membrane should be hurt.

"In cases of comminuted fracture, with depression of the splinters, it would be imprudent to wait the disappearance of the inflammatory symptoms, before making an attempt to raise and adjust the fragments; because, during the interval, the portions of bone might reunite in an unnatural situation, and produce deformity of the nose.

"Fracture of the nasal bones is sometimes attended with very dangerous symptoms, whether produced by a violent commotion given to the head, by the cause of the fracture, or by a co-existing fracture of the bones of the skull; or, as some authors think by the concussion communicated to the perpendicular part of the ethmoidal bone, and thence to its cribriform part, which would, in that case, be fractured, on account of its great tenuity. The laceration of the dura mater and its vessels, caused by the fracture of the cribriform lamella of the ethmoidal bone, would produce effusion, and thus give rise to all the symptoms. It is certain that cases have occurred where blows on the root of the nose have produced coma, convulsions and death; particularly when the nasal bones were not fractured." (Boyer.)

A piece of leather spread with adhesive plaster assists, by gentle compression, in preventing the displacement of the fragments, and as there is no danger of displacement from muscular action, no other dressing is necessary. I have seen a fracture of these bones in which one of the fragments punctured the facial artery as it passes over the nose. The hemorrhage at first was very profuse, but ceased after the fragments were reduced.

CHAPTER XX.

Fractures of the Lower Jaw.

This bone from its moving freely when struck, and also from its strength of texture is not very often fractured. It sometimes however is broken, and no part of it is secure from fracture. Mr. Boyer declares that its "symphysis at the chin is very rarely fractured though it is not impossible." I once saw an instance of fracture at this place. Sometimes it is broken in several places. I have known the jaw bone broken by a fall, into five different fragments. The middle piece in these cases is most difficult to be kept fixed, because of the muscles inserted into it which tend to draw it downwards.

It is liable to fracture in every part, from the condyles to the chin. The coronoid process is not often fractured except by gunshot wounds. The condyles are oftener broken. The fracture may vary greatly in its direction; it is sometimes transverse, sometimes oblique, sometimes in the direction of the bone, or longitudinal, separating the alveolar portion from the basis. It is generally simple, but sometimes compound.

The symptoms of a fractured jaw are very obvious; a severe pain at the part is felt at the time of the accident, and an inequality is perceived on passing the fingers along the basis of the jaw; upon examining the teeth they are found unequal, those situated upon one fragment being elevated above those of the other; when the two sides are taken in the hands it is easy to reduce the teeth to their proper level, and in doing so crepitation is perceived. These symptoms exist when the fracture is situated anteriorly to the angle of the jaw, when the condyles are broken, the fracture is not so very obvious, but may be ascertained by pain near the ear when the jaw is moved, and by crepitation occasioned by these motions. If considerable swelling occur before the surgeon is called, greater difficulty is experienced in determining the nature of the accident, and in these cases it becomes necessary to wait until the inflammatory symptoms subside.

The greatest danger attending a simple fracture of the lower jaw is that of consequent deformity, and this is very readily obviated by proper arrangement. Compound fractures, however, are more dangerous and are often followed by tedious exfoliations, and in some instances do not unite.

To reduce the fracture, nothing more is necessary than to shut the mouth, and forcibly push upwards the inferior fragment, until the teeth contained in it come in contact with those in the upper jaw. When all the teeth are upon a level, the fragments are to be supposed in apposition. It is not easy in all cases to keep them at rest in this position:—A variety of means have been contrived to effect this purpose, such as fastening the pieces together by passing wire around some of the teeth in each —forming a mould of moistened pasteboard to fit the chin, and binding this fast upon it. The simplest and best plan is to avail ourselves of the support given by the teeth in the upper jaw, by binding the fragments firmly against them, and this can be very conveniently done by means of a simple roller of muslin passed repeatedly round the top of the head and under the chin. It may be further secured by passing a few turns of it round the back of the neck and in front of the chin. The four-headed and double-headed bandages formerly used for this purpose, have no advantage over the roller, and it is by no means so easy to apply them neatly.

The patient should be nourished fifteen or twenty days on spoon victuals, sucked between the teeth, for which there is generally space enough, and this space is often augmented by the want of a tooth at some part of one of the jaws.—It has been proposed in comminuted and compound fractures, where the slightest motion is productive of great pain, to pass a catheter through the nostril, and inject the fluid aliment through it. If a case requiring such treatment should occur, no difficulty would be found in effecting it.

In fractures of the condyles of the jaw, that process is drawn forwards by the pterigoideus externus muscle; as it is very short there is no means of obviating this, and it becomes necessary therefore to push forward and keep in that situation the inferior fragment; in order to effect which, before applying the bandage as has been directed, a compress is to be applied behind the angle of the jaw extending nearly up to the ear, this compress when the roller presses tightly on it will keep the inferior fragment advanced sufficiently to come and remain in contact with the upper. In fractures of the condyles it is particularly necessary for the parts to remain at rest, as motion has sometimes prevented the reunion of the fragments and the condyle has exfoliated. Boyer relates a case in which this unpleasant event occurred: he extracted the condyle seven months after the accident through a fistulous ulcer.

Compound fractures of the lower jaws are very frequently attended with exfoliation, by which the cure is much protracted.

It often happens that one or more of the teeth are loosened at the fractured part; it has been advised to extract all loosened teeth, as extraneous matter. It is a fact, however, that the teeth under these circumstances very readily become fixed, and it is extremely improper to remove them, because the accident is thus converted into a compound fracture.

CHAPTER XXI.

Fractures of the Vertebræ.

THE spinal column moves readily in every direction, and being composed of a great number of separate pieces, of small size, is not very liable to fracture. The spinous processes are sometimes broken, because they are more slender and brittle than the other parts of the bone, project considerably backwards and are more superficial. Whenever the vertebræ are fractured, the force which produces this effect occasions also concussion of the spinal marrow, which is the only circumstance rendering the accident important, for the mere fracture of the vertebræ would heal as readily as that of any other bone. A palsy of all those parts which derive their nerves from below the fractured spot is the immediate consequence of every fracture of the spine which produces compression on the spinal marrow, whether this be by the pressure of bone or effused fluids. When this happens, therefore, in either of the three superior cervical vertebræ, immediate death ensues, from palsy of the fourth and fifth pair of cervical nerves, which chiefly supply the diaphragm, and which originate in the spinal marrow, a little higher than the place of their exit. Although death does not instantaneously follow the fracture of the fourth cervical vertebra, yet it very soon occurs.*

"The variety of causes which may give rise to symptoms analogous to those of fracture of the vertebræ render it difficult to establish a diagnosis. Yet when a person has fallen on his back from an elevated situation, or when a body very forcibly impelled, as a bullet discharged from a musket, has struck that part, if a fracture has taken place, some derangement of the spinal process of the fractured vertebræ may be observed, by an attentive examination of the part affected. Much pain is caused by pressing on that process; the inferior extremities are paralyzed, as also the rectum and bladder; the patient is afflicted with a retention of urine and fæces, or with an involuntary discharge of the latter.

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* A very remarkable case occurred in January 1816, which seems to form an exception to this general rule—a gentleman was shot by a pistol presented close to his face—the ball entered his mouth and shattered the atlas vertebra, notwithstanding which he survived the accident three weeks, and no symptoms of paralysis occurred, though the pus and the ball were in contact with the dura mater.

"This paralysis of the inferior extremities, the necessary concomitant of the fracture of the vertebræ is not in itself a mortal affection; but the patient losing the power of locomotion, and being obliged to lie perpetually on his back, soon feels a troublesome itching in the region of the sacrum on which the pressure of the body is principally concentrated. The skin of this part becomes inflamed and gangrene to a greater or less degree ensues, because the pressure on that part intercepts the course of the humours. The bone is quickly denuded, the ulcer extends rapidly and consumes the patient's strength, the dissolution is accelerated by the retention of excrements, from the paralysis of the rectum and bladder. The catheter which must be introduced into this latter organ for the purpose of evacuating the urine *gives admission to the air.*"* "Its mucus secretion becomes more abundant and its substance thickened. A slimy matter flows out with the urine, and the penis and scrotum become œdematous, a slow fever succeeds these symptoms, and the patient however robust he may be, falls in a few weeks.

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* The inflammation thus occasioned, is probably not excited, as Mr. Boyer supposes, by the admission of air, since there is no reason for supposing this fluid a powerful irritant, except when it produces fermentation, in the contents of a cavity.

We have known, however, a man of very vigorous constitution to have survived for six months an accident of this nature. Examples of recovery are recorded, but they are extremely rare, and to be ascribed to the secret operations of nature rather than to the efforts of art, and we repeat that scarcely one in thirty recovers; almost all die from the exhaustion of their strength, by slow fever, colliquative diarrhœa, &c.

" Any attempt at setting these fractures would be not only useless but dangerous, by the straining which it would occasion. General treatment alone can be had recourse to." (BOYER.)

In all cases of injury of the spine it is of extreme importance to introduce a catheter into the bladder, and to leave it in with a cork in the orifice, or to introduce it and evacuate the urine three or four times every twenty-four hours. As the patient in these cases feels no pain and is not conscious of the distention of his bladder, it is necessary for the surgeon to be aware of the importance of attending to this circumstance. A patient was brought into the Pennsylvania hospital in the summer of 1812, who had been wounded in the spine, by a musket-ball two weeks before in a naval engagement. He had received very little attention after the accident; immediately on his admission I ordered the catheter to be introduced, when nearly three quarts of urine were drawn off; he had voided none for two weeks.

It has been recommended to trepan the spine in cases of paralysis from fracture, and to remove the depressed bone or effused fluids, as in cases of fractured cranium. This operation could not be performed without extreme difficulty, and the greatest uncertainty of relieving the compression. The inflammation likely to follow the operation, would probably occasion a repetition of the pressure from distention of the vessels within the spinal cavity.

Dr. Physick has attempted to relieve the effects of fractures of the vertebræ, by making extension and counter-extension from the head and feet of the patient, the head being secured to the upper and the feet to the lower part of the bedstead. In the first case in which it was used, the fracture was situated in the fifth and sixth cervical vertebræ; the patient regained after the extension, the use of his arms which had been paralytic, but expired shortly after, apparently from a collection of mucus in the trachea which he was unable to cough up, from palsy of the expiratory muscles. Perhaps as some relief was in this case experienced the remedy may be worthy of trial.*

In examining patients with fractures of the spine it is of extreme importance not to turn them on their faces, but to conduct the examination whilst they lie on one side—suffocation has resulted and instant death from neglecting this caution.

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* An account of this case may be seen in Dr. Hartshorne's edition of Boyer.

CHAPTER XXII.

Fractures of the Ribs.

The ribs in consequence of the elastic cartilages in which they terminate, and of the strength derived from their arched form, are not very often fractured. The first rib is very seldom broken, as the shoulder and clavicle protect it greatly from accidental violence. The ribs are most commonly broken by falls from a considerable height, and sometimes by violent blows. They are generally broken near their middle, by a transverse fracture; sometimes the fracture is oblique, and inconveniences result from the sharp extremities of the fragments; sometimes these penetrate the external integuments, forming a compound fracture, and sometimes they pierce the pleura and lung, and thus occasion emphysema.

The fracture is ascertained by an acute pain in breathing and by careful examination with the hand, and by pressing the rib in different parts a crepitus may sometimes be felt. To assist in the investigation the patient should be desired to cough whilst the surgeon's hand is kept on the part injured, if any fracture exist the act of coughing will generally produce crepitation.

In many cases, especially in very corpulent subjects, there is great difficulty in ascertaining the existence of the accident, and in all these cases the dressings should be applied as if a rib actually were fractured.

From the articulation of the ribs to the sternum before, and the vertebræ behind, no diminution of length can take place; no lateral derangement of the fragments can happen, because the intercostal muscles act equally on both fragments, and tie them to the uninjured ribs above and below. The only derangement which can happen, is by an angular projection internally at the place of fracture.

The only treatment necessary in simple fractures of the ribs whether one or several be broken, is to keep the parts at rest as much as possible during their reunion, and this is done by counteracting in great measure their motions in respiration. To effect this, a bandage six inches wide is to be passed repeatedly round the chest as tight as the patient can suffer it to be drawn. Its descent may be prevented by a shoulder-strap. When this is done respiration is performed, principally by the action of the diaphragm, and the ribs remain, comparatively at rest. Instead of the roller, a jacket of strong linen may be used capable of being laced very tight by means of tapes.

When the lungs have been wounded by a fragment of the bone, the patient generally spits blood and coughs violently—the lungs inflame, and violent fever comes on, attended with difficult respiration and other symptoms of pneumonia. Copious blood-letting, and the usual remedies for inflammation must in such cases be employed.

When emphysema occurs from a fractured rib, it is to be treated in the same manner as has been recommended when this affection is consequent to a wound of the thorax. If the complaint proceed to any considerable extent an incision is to be made into the thorax; it is, however, a very rare occurrence: to prevent it, it has been recommended to bind a compress very firmly over the fracture.

When the cartilages of the ribs become ossified, as they often do in advanced life, they are also liable to fracture, the accident is to be treated just as a broken rib.

CHAPTER XXIII.

Fractures of the bones of the Pelvis.

THE OS SACRUM is not often fractured—a carriage passing over it, or a heavy weight falling on it, may occasion a fracture: no muscles are inserted into it which have any agency in moving the fragments, and the only remedy is rest in a horizontal posture. If extensive inflammation result from the contusion accompanying the fracture, it is to be treated as usual. If suppuration take place, and abscesses form, they must be opened as soon as possible, to prevent the formation of fistulous ulcers. When large extravasation takes place within the pelvis, bleeding and low diet are to be ordered, with a view to prevent suppuration, which in this situation would prove a very serious evil.

The OS COCCYGIS is sometimes broken, though very rarely—the existence of this fracture is ascertained by pain in the part, and in every attempt to walk this pain is augmented: by introducing the finger into the anus, the fragments may be felt. The only remedy necessary is rest and gentle compression, by means of a compress supported by a T bandage.

The OSSA INNOMINATA are occasionally broken by a variety of accidents; the fracture occurs in different situations. Mr. S. Cooper has seen instances of fracture in the ilium, the ischium, and the os pubis. I have seen the acetabulum fractured in such a manner as to occasion incurable lameness. The ilium, however, is more frequently broken than either the ischium or pubis. The fracture of these bones, is in itself of less consequence than the mischief occasioned by the force which produced it. The contents of the pelvis must be contused severely by any force great enough to fracture the bones which form it, and generally extravasations of blood take place into the cellular texture, which intervenes between the viscera of the pelvis.

A fracture of the os innominatum, is to be known by the usual symptoms of pain and crepitation upon moving the fragments; an inability to walk also occurs, but any severe injury to the pelvis produces this: fractures of these bones have often been found after death, when their existence has been unsuspected.

The treatment consists chiefly in obviating inflammation by the usual remedies, as no displacement of the fragments is likely to occur. The inconveniences of discharging the urine and fæces, are sometimes very great in these accidents, but they are much diminished by the use of sir James Earle's bed. In some cases suppuration takes place, notwithstanding the free use of evacuating remedies, and large abscesses form: splinters of bone have been found to occasion these collections of matter. "Desault in giving an exit to a collection of urine which had taken place from a fracture of the pelvis, found a splinter which he extracted from the bottom of the wound. If the bladder be perforated by a splinter, this should be extracted, and a catheter introduced, in order to prevent the accumulation of urine and its consequent effusion into the cavity of the abdomen;" an accident which has occurred.

CHAPTER XXIV.

Fractures of the Scapula.

THE mass of muscular flesh which surrounds the scapula, and its great mobility, protect it in great measure from fracture; some parts of it, however, are more exposed than others. The accromion process forms the most projecting part of the shoulder, and is oftener fractured than any other part of the scapula; the inferior angle is the part next in frequency found broken. The coracoid process has seldom been known fractured: a gunshot wound, and the falling of a heavy body directly upon it, have sometimes, however, occasioned this accident.

The force which produces the fracture generally occasions much contusion of the adjacent flesh. When the scapula is broken longitudinally, the muscles on its surfaces prevent a displacement of the fragments, transverse fractures are more apt to be accompanied with a derangement of them. The serratus major anticus muscle, draws forward the lower portion to which it is principally attached. The inequality is evidently perceived by passing the fingers along the base of the scapula.

To ascertain the existence of the fracture, it is necessary to examine particularly whether any derangement is evident, and whether any crepitation can be produced by pressing the bone in different places. The only fractures which are not easily discoverable in this way are the longitudinal. The lower angle when broken off moves easily under the fingers, whilst the rest of the bone is stationary.

When the fracture is longitudinal, or transverse through the scapula, a roller is to be applied round the chest and arm, so as to confine the arm close to the side; this roller should cover the arm down to the elbow.

"As the inferior angle when separated by fracture from the rest of the bone, is like the condyloid process of the jaw, little susceptible of being acted on by any means in our power, it will be necessary to act on the scapula itself, to push it downwards and forwards, towards the inferior fragment which the serratus major anticus has drawn in that direction. In this case too, it is on the arm that it will be necessary to act, in order to move the scapula. The arm is to be pushed inward, forward, and downward, the fore arm being half bent. It must be kept in this position by a circular bandage seven yards long. It will be proper at the same time to act on the angular detached portion by means of compresses, which may be pressed backward by some rounds of a bandage, and thus brought in contact with the rest of the bone. The arm may be supported in a sling tied on the opposite shoulder." (BOYER.)

"The accromion when fractured is drawn outward and downward by the action of the deltoid muscle, at the same time that the rest of the bone is drawn upward and backward by the trapezius and levator scapulæ. This fracture is set, by raising the arm in such a manner as that the head of the humerus may push upward the accromion, which has descended, and which naturally covers it like an arched roof, at the same time an assistant pushes the scapula forward and downward, in a direction opposed to that which is given to the arm"—in order that the parts may remain in this situation, bandages are to be applied—"a circular bandage is to be applied round the trunk and arm, and afterwards made to ascend from the elbow to the shoulder, and vice versa." "This bandage like all those of the thorax is very liable to be displaced, and therefore to be frequently reapplied, never forgetting on these occasions to have the elbow raised and the shoulder pressed down." (BOYER.)

Although fractures of the scapula consolidate in the ordinary time of thirty-five or forty days, yet in those of the accromion it will be necessary to continue the bandage a little longer; not that the generation of callus is slower in that part than in any other, but because the accromion is acted on by strong muscles, which might rupture the callus if exposed to their action before it had acquired a great degree of solidity.

CHAPTER XXIV.

Fractures of the Clavicle.

THE clavicle is perhaps as often broken as any bone of the body. Its exposed situation at the upper part of the trunk, its long slender shape, and its being covered only by the common integuments, expose it to frequent accidents.

The fracture commonly occurs near the middle of the bone, as it is here most prominent, it is also occasionally broken near the sternal, and humeral extremities. When fractured by the falling upon it of a heavy body, the nerves of the arm become paralyzed by the contusion.

In general the fragments are displaced, unless it is broken near the shoulder, in which case its firm connexion by ligaments with the scapula prevent the displacement. The external fragment, or that nearest the shoulder, is drawn downwards by the weight of the arm, and the action of those fibres of the deltoid muscle, which are inserted into it, and also by the pectoralis major, which when it is depressed draws it forwards, or inwards towards the sternum; so that the sternal portion is always found riding over the humeral; the arm of the affected side falls over upon the breast, and the patient is unable to rotate the humerus, so that it is impossible for him to raise his hand upon his head. He leans to the fractured side, and the attitude is so remarkable, that the celebrated Desault it is said, was never deceived in deciding from this circumstance alone, the existence of the fracture. Crepitation may easily be produced by moving the arm, and the finger passed over the clavicle readily detects the place of fracture.

This accident in itself is not dangerous, but becomes so when accompanied with great contusion or laceration of the neighbouring soft parts.

The treatment of this fracture has been the source of much difficulty among surgeons, a vast variety of machinery has been contrived for the purpose of keeping the fragments together, and lately a surgeon of great and deserved celebrity* has renounced all applications and trusts to rest in a horizontal posture, as the only necessary remedy. I refer to Mr. Boyer for a concise account of the discarded apparatus of the older surgeons. Mr. Desault was the first who properly contemplated the difficulties to be surmounted, and constructed an apparatus, which better than any before in use, removes them. His plan with different modifications has been very generally used in this country, and continues to be preferred to all others, I shall therefore describe it. It is not the smallest advantage of his dressings that they are always at hand.

"The pieces of which this apparatus is composed are, 1st, Three rollers three inches broad; the two first six, the other eight ells long, each one rolled up separately.

2d, A bolster or pad (Fig. 1. *a b*) made in the form of a wedge, out of pieces of old linen. Its length should be equal to that of the humerus, its breadth four or five inches, and its thickness at the base about three inches.

3d, Two or three long compresses.

4th, A small sling for the arm.

5th, A piece of linen large enough to cover the whole bandage.

Every thing being properly arranged, the following is the mode of applying the apparatus, which of itself reduces the fracture.

The patient being placed in a standing position, or if his case render that impracticable on a seat without a back, an assistant elevates the arm of the affected side, and supports it at nearly a right angle with the body, (Fig. 2.) whilst the surgeon places under the arm-pit the head of the bolster, which descends along the side of the thorax, and which another assistant situated at the patient's sound side holds by two upper corners.

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* Mr. Pelletan, surgeon in chief to the *Hotel Dieu*, &c. &c. &c.

The surgeon now takes one of the first rollers, applies the end of it on the middle of the bolster, fixes it there by two circular turns round the body, and passes a turn obliquely (*a a*) along the fore part of the thorax ascending to the sound shoulder. The roller then descends behind, passes under the arm, and returning in front of the thorax, makes a circular turn and a half horizontally. Having reached the hind part of the thorax it reascends obliquely by the cast (*b*) as it had done before, and passes over, before, and under the sound shoulder; having thus crossed the turn (*a a*) the roller again passes across the hind part of the thorax, and finishes by circular turns which completely cover the bolster. A pin is now to be fixed in the place of crossing of the roller on the sound shoulder, to prevent the turn (*a*) from slipping downward.

The application of this first roller is intended for no other purpose than firmly to fix the bolster, which is held up by the two oblique turns before and behind, and secured against the body by the subsequent circular turns.

The bolster being fixed, the surgeon applying one hand to its external surface pushes it upwards, and with the other, taking hold of the elbow, after having half bent the fore arm, lowers the arm till it is laid along the bolster. He then presses its lower extremity forcibly against the side of the thorax, pushing it upwards at the same time and directing its upper extremity a little backwards.

The application of the bandage constitutes a part of the process of reduction. The humerus, now converted into a lever of the first kind, is drawn at its upper end from the shoulder, in proportion as its lower end is approximated to the thorax. The scapulary fragment being drawn along with it, and directed at the same time upwards and backward, comes into contact with the sternal fragment, and in an instant the deformity of the part disappears.

The arm being thus situated is given in charge to an assistant, who retains it in the same position in which he received it from the surgeon, by pressing on it with one hand, and with the other supporting the fore arm half bent, and placed horizontally across the breast.

The second roller is next to be applied. The end of this is carried under the arm-pit of the sound side. It is then brought across the breast, over the superior part of the diseased arm, and extends across the thorax behind till it passes under the arm-pit. Two circular turns cover the first. The roller must then ascend to the lower part of the shoulder by oblique turns (*c c* Fig. 3.) each of which must be overlapped by the succeeding one to the extent of about the third part of its breadth. It is necessary that these turns be applied in such a way as to bind but very gently above, and to increase in tightness, as they descend nearer to the lower extremity of the humerus.

The use of the second roller is to supply the place of the hand of the assistant in pressing the arm against the side of the thorax, its effect evidently is to draw the upper extremity of the arm outwards, and as it is already directed backwards, to retain it in that position. The compression of the circular turns on the arm, being thus gradually augmented, becomes on the one hand more efficacious, because it acts on a greater surface; and on the other less troublesome, because being more divided it is less felt at the lower extremity of the arm, where it bears with most force.

A third indication remains to be fulfilled, namely, to retain the shoulder in its elevated position, and by that means to assist in the extension of the fragments, which already has some effect in preventing a depression.

To fulfil this indication, an assistant sustains the elbow in its elevated position with one hand, and with the other supports the patient's hand before his breast, whilst the surgeon fills with lint the hollow spaces around the clavicle. He then applies on the clavicle at the place where it is fractured, the two long compresses, wet with vegeto mineral water, a solution of sugar of lead, or some other cooling liquid. Taking now the last roller, he fixes the end of it under the sound shoulder, from thence he brings it obliquely across the breast, over the long compresses, and carries it down behind the shoulder along the posterior part of the arm, till it passes under the elbow. From this point he again carries it obliquely upwards across the breast to the arm-pit, then across the back over the compresses, and brings it down again before the shoulder along the front of the humerus, till it again reaches the elbow. From thence the roller again ascends obliquely behind the thorax, passing under the arm-pit where the first coat of the roller is covered, and from whence it again starts to run the same course we have just described. This constitutes a second round, which covers in part the first, and forms a kind of double triangle, *e*, *f*, *d*, situated before the breast, and over the circular turns of the other rollers (*c c* Fig. 4.) The remaining part of the roller brought from behind forward, is employed in circular turns over the arm, and round the thorax for the purpose of preventing the displacement of the first part. To make it the more secure it is fastened with pins or stitches at its different places of crossing.

The sling (Fig. 4.), is next passed under the hand, and fastened above to the ascending turns (*d*) and not to the circular (*c c*), which the weight of the hand would be likely to draw downward.

It is only necessary to examine the course of this third roller to see that united to the sling; it is well calculated to support the external fragment, which the weight of the shoulder, has a tendency to depress on a level with the internal one. It supplies the place of the assistant who raises the elbow, and supports the hand of the patient, in like manner as the second roller performs the office of the assistant who presses the lower part of the humerus against the side of the thorax.

On the other hand, the circular turns by which the application of the third roller is finished, being directed from before backwards, push in the same direction the arm and shoulder, which have been already carried that way, by the process of reduction, and thus retain them in their proper places." (DESAULT.)

By this apparatus the shoulder is kept, *upward, backward*, and *outward*; the weight of the arm and the action of the muscles, are thus effectually prevented from drawing the humeral fragment inward, and downwards.

"The coats of the rollers thus surrounding the thorax, however well they may be secured, are yet liable to be displaced, particularly when the patient is in bed. This inconvenience may be obviated by surrounding the whole with a piece of linen, leaving nothing uncovered but the sound arm, which is at liberty to perform its usual motions."

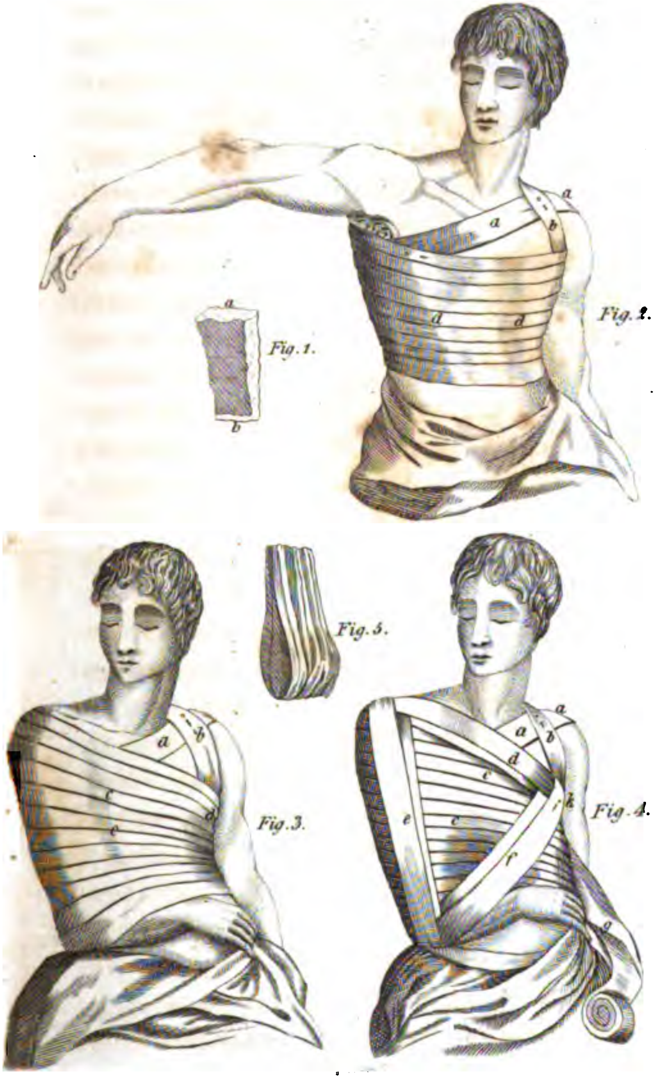
It is better, however, to add to the firmness of the dressings by connecting them together with several rows of stitches in different places.

This mode of treating fractured clavicle has been found extremely successful, but it has its inconveniences; the principal one that I have experienced in its use, is the numbness of the arm, and stoppage of the circulation, which occur in consequence of the pressure of the bolster in the axilla, upon the vessels and nerves of the arm. Great attention is necessary to obviate this by diminishing when it occurs, the tightness of the bandage, which passes round the arm near the elbow; to judge whether the pressure be too great, the pulsations of the radial artery at the wrist should be attended to; if they be interrupted the bandage must be loosened. Another inconvenience results from the slipping down of the pad in the axilla; I have in some cases, with advantage, attached a piece of tape to it, and tied this on the opposite shoulder. Whenever the dressings become slack they must be tightened; without attending to this circumstance they are useless.

Mr. Boyer, availing himself of the principles of Desault, has constructed a very simple apparatus which acts in the same manner, and is very easily applied.

It consists of a girdle of linen cloth quilted, and six inches broad, which passes round the trunk on a level with the elbow. It is fixed on by three straps, and as many buckles fastened to its extremities. At an equal distance from its extremities, on each side, are placed two buckles, that is, two anterior, and two posterior to the arm. A bracelet of quilted linen cloth five or six fingers broad, is placed on the lower part of the arm of the side affected, and laced on the outside of the arm; four straps fixed to this bracelet, that is, two behind and two before, correspond to the buckles on the outside of the girdle already described, and answer the purpose of drawing the lower part of the arm close to the trunk, the more so, as the straps by being two before, and two be-

PLATE. IV.



hind, prevent the arm from moving either backwards or forwards. With this apparatus, as well as the preceding, the cushion must be applied under the arm.

I have never seen this plan used, but have no doubt it would answer very well. It cannot, however, be free from those inconveniences of Desault's which result from pressure in the axilla, and the weight of the arm, appears to be less completely supported.

In about four or five weeks the fracture will generally unite, and no particular attention is necessary to diet or regimen; the patient may be allowed to walk about during the cure.

CHAPTER XXVI.

Fractures of the Os Humeri.

The os humeri is fractured most frequently near its middle; occasionally, however, in all its parts. I have known it fractured in one case within the capsular ligament, the fracture extending through the head of the bone. Fractures above the insertion of the pectoral and latissimus dorsi muscles, are called fractures of the neck of the bone. The lower extremity is also broken, and in some instances the condyles are detached from the rest of the bone, and from each other.

When the fracture is transverse, and is situated near the middle of the bone, no great derangement takes place, the fragments supporting each other, and the limb preserving its length, and unless moved, its form. In oblique fractures, the limb is shortened by the action of the muscles, and considerable alteration in its shape is perceived.

When the *bone is fractured at its upper end, or neck*, there is some difficulty in distinguishing the accident from a dislocation of the head of the bone into the axilla. It can always, however, be known, by a depression at the upper and external side of the arm, very different from that depression which occurs in dislocations, and which is situated immediately under the accromion scapulæ. In the present instance, the shoulder retains its natural rotundity, and no depression exists directly under the accromion. The axilla being examined with the fingers, the fractured unequal surface is readily felt; whereas, in dislocations, the round head of the bone is felt high up in the arm-pit. By moving the arm the grating of the fractured surfaces can be distinctly perceived. The best manner of treating this accident, is that described by Desault.

"The patient is to be seated on a chair, or on the side of a bed, the arm is slightly separated from the body and carried a little forward. One assistant is directed to fix and secure the trunk in a proper manner; this he does by pulling the arm of the sound side, taking hold of it near to the hand, and extending it in a direction perpendicular to the axis of the body. This mode of counter-extension, is preferable to that commonly employed, which consists in applying the hands to the upper part of the patient's shoulder; because on the one hand, the power being further removed from the resisting force need not be so great, and on the other, the body being entirely unincumbered renders it easy for the surgeon to apply the roller, without discontinuing, or in any way disturbing the extension. Another assistant makes extension on the fore arm, which serves him as a lever, where one hand being placed behind, or on the back of the wrist, forms the point of support, or fulcrum, while the other applied to the anterior and middle part of the fore arm, on which it makes pressure from above downward, constitutes the power, and the fragments to be brought into contact, the resistance.

The relaxation of the muscles produced by this semi-flexion of the fore arm, and the separation of the arm from the trunk, greatly favours this mode of extension; a mode, recommended by the ancients, adhered to by the English, and which possesses the advantage of leaving uncovered all that portion of the limb on which the apparatus is to be applied, and by that means of allowing the hands of the assistant to keep the same position during the whole time of the application. A small degree of force directed according as the displacement is inward or outward, is sufficient to effect the reduction, which even takes place of its own accord under this process. If the surgeon lays his hands on the place of fracture, it is rather to examine the state of the fragments, than to assist in bringing them into apposition."

In order to keep the parts in this state of reduction, the surgeon takes a roller, fixes one end of it by two circular turns, on the upper part of the fore arm, and carries it up along the arm by oblique turns moderately tight, and overlapping each other about two thirds of their breadth. Having reached the upper part of the limb, he makes some reversed turns to prevent the wrinkles, which would otherwise be caused by the unevenness at this place. He then passes two casts of the roller under the opposite arm-pit, and brings it to the top of the shoulder again; a splint* is then placed *before*, which reaches from the fold of the arm to a level with the acromion; another on the *outside* reaching from the external condyle to the same level; a third reaching from the olecranon to the fold of the arm-pit.† These splints are to be secured in their situation by the roller brought down over them and secured at the elbow. A bolster is now applied between the arm and side; Desault advises this bolster "to be made of linen from three to four inches thick at one end, tapering like a wedge to the other, and of a sufficient length to reach from the arm-pit to the elbow." If the displacement be in an inward direction, the thick end is to be placed uppermost, and if outward, which is commonly the case, the thin end. This bolster is to be pinned to the roller, and the arm then secured against it, by a roller passed round the arm and body, (as in cases of fractured clavicle), sufficiently tight to keep the arm firmly fixed against the bolster. Instead of the cushion or bolster recommended by Desault, compresses of folded flannel or linen may be substituted, and they can be made thicker at one place than another, according as the displacement inward or outward, may require. The fore arm is to be suspended in a sling. From twenty-six to thirty days are required for the reunion of the fragments. It is of consequence in this accident, from the vicinity to the joint, to prevent any displacement of the fragments, as their union under such circumstances would greatly impede the motions of the limb. The apparatus just described, which varies in nothing important from that of Desault, will effectually prevent this inconvenience.

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* Firm pasteboard answers very well for this purpose.

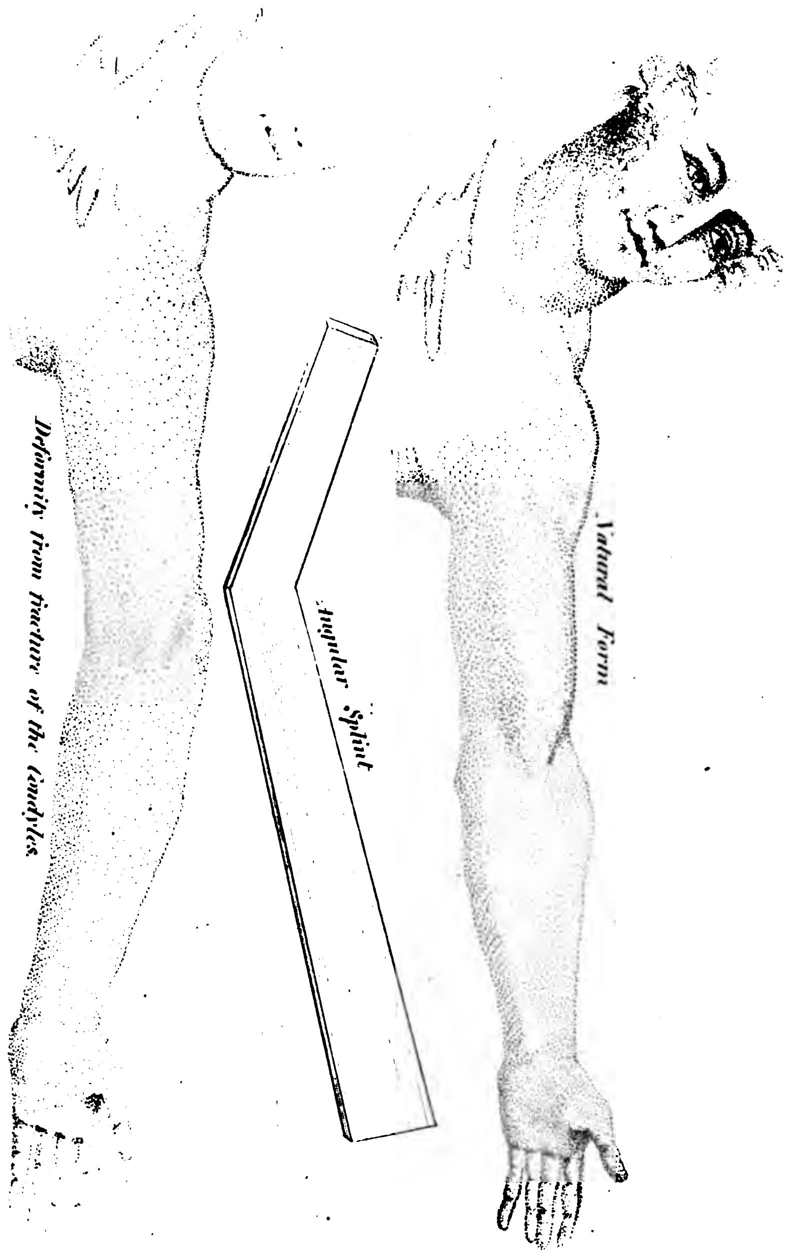
† Two splints, each two inches wide, are generally sufficient in this fracture.

Fractures occurring in the middle of the bone, or in any situation between the immediate vicinity of the elbow and shoulder joints, are very easily dressed. Counter-extension is to be made by an assistant with his arms round the chest; extension is to be made by another assistant who draws down the arm, taking hold below the elbow. The surgeon readily places the fragments in contact, when the arm will be found to have its proper length and shape; the external condyle corresponding with the most prominent part of the shoulder. A roller is now to be applied, extending from the wrist to the shoulder (to prevent tumefaction of the fore arm); the fore arm is to be bent to a right angle with the arm; when the roller reaches the elbow, three or four splints according to the bulk of the arm, (I have never, however, seen more than three necessary,) are to be applied to the outer, inner, and back part of the arm, and secured by bringing down the roller over them: these splints should be two and a half inches broad, long enough to extend from the shoulder to the elbow, the inner one will be several inches shorter than the two others, to allow the flexion of the fore arm, and to prevent excoriation at the axilla. They may be made of thin wood, or strips of wood glued upon leather, or tin, or what I have always preferred to every other material, thick pasteboard, such as is employed for the covers of books. When pasteboard is used in this case, it need not be soaked in water, but bent so as to fit the arm. The roller must never be bound so tight as to cause pain. The arm must be supported in a sling, and the patient, in general walks about during the cure, which is commonly completed in four weeks. At the expiration of a week (and in most other fractures the same thing should be done) the dressings are to be removed and the part examined, and any displacement rectified before they are reapplied.

When the fracture is situated *near the condyles*, or at the condyles, a very different mode of treatment is to be adopted. A deformity is extremely apt to occur after this accident, and the motion of the elbow is much impeded. To obviate this, Dr. Physick has for many years been in the habit of applying two angular splints, which keep the fore arm flexed at a right angle upon the arm. The fracture being reduced, and the parts placed in their proper situation, a roller is to be applied as usual, from the wrist to the shoulder, and brought down over the angular splints: these splints are made of pasteboard or wood, an inch and a half wide; the part applied to the arm, extends from near the shoulder to the elbow, and the part applied to the fore arm, should be long enough to reach to the ends of the fingers, to obviate the motions of the hand; a handkerchief passed round the neck, supports the weight of the arm.

After a week has elapsed, the dressings are to be removed, and the joint carefully and gently flexed, and extended several times to prevent stiffness; after which they are to be carefully reapplied, and this is to be re-

PLATE V.


Deformity from fracture of the Condyles.
Angular Splint
Natural Form

peated once in every forty-eight hours, increasing as the cure advances, the motion of the joint. At the end of three weeks the mode of dressing is to be altered, and splints forming an obtuse angle are to be substituted for the rectangular, which had been first employed. The object of this change is to prevent a kind of deformity, which though not very important in man, as it does not interfere with the motions of the joint, is, however, of more consequence to females. The deformity alluded to, consists, in an *angular projection of the elbow, outwards.* It is most evident when the whole arm is placed at right angles to the body, with the thumb upwards, the patient standing erect. In that case, instead of a gentle curve downwards at the elbow, which is natural, the curve is directly reversed. I have attempted to represent it in the annexed sketch, in which the natural and the deformed appearances, are contrasted. The effect is particularly apt to occur, when the condyles are broken off directly at the joint, and when in addition to this transverse fracture they are also separated from each other, which sometimes happens, from the extreme thinness of the bone between the two condyles, occasioned by the space for receiving the olecranon behind, and the coronoid process of the ulna before. The mode of treatment just described, has in several instances, been completely successful in preventing deformity, and preserving the perfect motions of the elbow.

Dr. Physick has since ascertained that the same end may be answered by keeping the patient in bed, with the arm flexed at the elbow, and lying on its outside, with rectangular splints, supported by a pillow.

CHAPTER XXVII.

Fractures of the Fore Arm.

These are very frequent accidents, and are produced by a variety of causes. Sometimes both bones are broken, sometimes the radius only, and sometimes the ulna. When *both bones of the fore arm are fractured,* by the same force, the fracture in each bone is generally on the same level; but sometimes one bone is broken higher up than the other. The interosseous ligament which connects the bones of the fore arm together, generally prevents a separation of the fragments in the longitudinal direction; the derangement is most commonly in a transverse direction, the four fragments approaching each other at the injured part, and a considerable change in the shape of the arm is perceived.

The symptoms of the fracture are very obvious; great pain at the time of the accident, which is augmented by every motion of the hand; an inability to pronate or supinate the hand; mobility at the place of fracture; crepitus when the fragments are moved, and deformity of the member. These symptoms are not so obvious when the fracture occurs near the wrist; the accident has in such cases, been mistaken for a dislocation. Boyer mentions as the best diagnostic symptom that, when the fracture exists, the styloid processes of the radius and ulna follow the motion of the hand when the wrist is flexed; whereas in cases of dislocation they remain fixed. The dislocation is a very rare accident, and the fracture a very frequent one; in most cases, the crepitus when the fragments are moved decides the nature of the injury.

To reduce the fracture, the fore arm is bent to a right-angle with the os humeri. An assistant takes firm hold of the arm just above the elbow, another grasps the patient's hand, and the necessary extension is then made. The surgeon very readily adjusts the fragments.

To dress the fracture a roller is applied, commencing at the hand and extending a little above the elbow; two firm splints of pasteboard (not soaked in water), are to be next applied; compresses of linen, flannel, or tow, being interposed, to fill up the spaces between the splint and arm: the roller being brought down over these splints secures them in their situation; the thumb being uppermost may be left projecting out between the splints, as an indication that no rotatory motion has displaced the fragments. The splints used in dressing all fractures of the fore arm, should be long enough to extend from the elbow to the extremities of the fingers, and a little wider than the broadest part of the arm. They should be long, in order to confine the fingers from moving, by which irritation would be occasioned, and possibly a displacement of the fragments, because the muscles moving the fingers, are situated on the fore arm; and they should be broad, because the roller passed round narrow splints would press the fragments together, and thus by diminishing the interosseous space, greatly impede the motions of the limb: for the same reason the roller first passed round the arm should not be drawn tight over the place of fracture. The compresses placed on each side of the arm, being pressed by the splints upon the soft parts situated between the bones, force them between the two bones and thus obviate the inconvenience alluded to: all that remains, is to place the arm in a sling. After a week or ten days, the dressings should be removed and the part examined; any deviation from the proper position can at this period be remedied. In thirty or forty days the cure will generally be completed. Whenever the fracture occurs near the elbow or wrist, the dressings should be removed every forty-eight hours after the tenth day, and the joint gently flexed and extended before they are re-applied.

If much contusion be occasioned by the cause of the accident, the patient is to be confined to his bed, and the inflammation combatted by the usual remedies.

A compound fracture requires the confinement of the arm upon a pillow, and instead of the roller a bandage of strips is to be applied (called *Scultets*, from its inventor Scultetus;) the wound is to be dressed in such a manner as to promote its speedy union: if it be small and not greatly contused, it may be allowed to scab, and dry lint is to be applied over it: if great laceration exist, a poultice will be found necessary.

2. *When the Radius* only, is broken, which is most frequently the case in fractures of the fore arm, the member cannot be bent at the place of fracture, as the ulna being uninjured, preserves its firmness. The existence of the accident is discovered by drawing the hand along the edge of the radius firmly, when the fracture can be felt by the angle of one of the fragments; great pain is experienced in attempts to rotate the hand, and the crepitus can generally be heard. When the radius is broken near its upper extremity, the depth of muscle in which it is imbedded, renders the diagnosis more difficult. In these cases Mr. Boyer recommends that "the thumb be placed under the external condyle of the os humeri, and on the superior extremity of the radius, and at the same time, the hand is to be brought to the prone and supine positions. If in these trials, always painful, the head of the bone rests motionless, there can be no doubt of its being fractured." There can be no derangement of the fragments in fractures of the radius, except what the muscles occasion by drawing one or both fragments to-

wards the ulna; and the pronators principally effect this.

The treatment of this accident is similar to that recommended when both bones are broken; the ulna, however, acts as a splint in the present case, and aids in keeping the fragments at rest; but it has no effect in preventing their lateral displacement, and therefore compresses must be applied between the splints and the fore arm, to keep up pressure upon the interosseous muscles, and thereby preclude the approximation of the fragments, to the ulna.

3. When the *ulna* is alone broken, the fracture is easily discovered by passing the hand along it, as it is superficial, and easily felt from the olecranon to the wrist. The treatment is the same as in fracture of both bones, unless the fracture happens high up, near the joint.

When the *olecranon* is fractured, no difficulty is experienced in detecting it. The fracture is generally transverse, and as the triceps extensor cubiti, is inserted into it, the upper fragment is generally separated considerably from the lower, and the patient loses the power of extending the fore arm: a wide space is generally felt and seen between the fragments, and they readily move upon each other producing crepitus. The proper treatment of the accident is well described by Boyer. "The divided parts, are brought into contact by extending the fore arm, and pushing down the olecranon from the place to which it had been drawn up by the action of the triceps. The principal object is to counteract the action of this muscle, which tends incessantly to separate the detached olecranon from the ulna. To effect this purpose, a circular bandage moderately broad, is passed on the fore arm fully *extended,* this being done the olecranon is pushed down into contact with the ulna, and the middle part of a long compress placed behind it, the extremities of which are brought downward, and crossed on the anterior part of the fore arm, after which several turns of the bandage made so as to cross one another, are carried round the articulation of the elbow; the bandage should then be rolled up on the humerus, in order to diminish by pressure the irritability of the triceps, which is relaxed by extension of the fore arm. This bandage being applied, the bend of the fore arm is filled with lint, and a long splint applied on it anteriorly, by which the flexion of the arm is prevented. The splint is fixed by the same bandage, rolled on downward from the shoulder to the wrist. The oblique casts of the roller which cross one another on the articulation, forming a kind of figure of 8, ought to be nicely applied and drawn very tight; because if but slightly braced, their action, which is oblique, will not be sufficient to confine the olecranon in its situation. Previous to the application of these oblique casts, the skin of the olecranon should be drawn up by an assistant, for if this precaution be not taken, it may sink between the divided portions and prevent their contact.

Though the contact be exact, immediately after the application of the bandage, yet if, as is apt to happen, the bandage become relaxed, or if the patient inadvertently contract the triceps, the olecranon ascends; because the bandage acting perpendicularly to its direction, can but feebly oppose the ascent of this process: an interval will therefore exist between the ulna, and olecranon, which will be filled up by granulations, and by the thickening of the periosteum, or tendinous expansion of triceps which covers that bone, and the reunion of the parts will be effected by means of an intermediate ligamentous substance, the length of which will depend on the careful application, and frequent renewal of the bandage. In forty or forty-five days the ligamentous substance acquires its greatest consistence, but the articulation should not be kept motionless so long; gentle motion may be commenced on the twenty-fifth or thirtieth day. The object of these motions is to prevent a false anchylosis of the articulation.

In cases of recovery obtained by these means, the olecranon adheres to the ulna firmly enough to transmit to it the action of the triceps muscle, and to moderate the extension of the fore arm.

Compound fracture of the olecranon is an accident of the most grievous nature, on account of the great number of nerves which pass in the neighbourhood of that part. It should therefore be treated with the greatest care. The inflammatory symptoms are to be treated by copious and repeated bleedings; the arm is to be placed half bent on a pillow and dressed with Scultets bandage. In these cases the intermediate ligamentous substance is always greater than in simple fracture, and consequently the force of the arm is much diminished. If a false anchylosis be prevented by judiciously exercising the articulation as soon as the state of the parts will permit, the patient may think himself fortunate.

If the inflammatory swelling, &c., be not dissipated before the twenty-fifth or twenty-sixth day, the application of the apparatus we have just described will be useless, because it will be necessary at that time to begin to exercise the articulation, the formation of the ligamentous substance being then considerably advanced." (Boyer.)

The coronoid process of the ulna, Dr. Physick has once seen broken. The symptoms resembled a dislocation of the humerus forward, or rather a luxation of the fore arm backward, except that when the reduction was affected, the dislocation was repeated, and by careful examination, the crepitation was discovered. The fore arm was kept flexed at a right angle with the humerus. The tendency of the brachieus internus to draw up the superior fragment, was counteracted in some measure, by the pressure of the roller above the elbow. A perfect cure was readily obtained.

CHAPTER XXVIII.

Fractures of the Wrist and Hand.

Fractures of the bones of the carpus very rarely occur, except in gunshot wounds, or by a heavy body falling upon them. In every case of this accident which I have seen, the fracture has been an object of secondary importance, and amputation has in general been necessary from the nature of the injury. Where the limb is to be preserved, the hand is to be placed in a straight position and kept at rest by splints and bandages.

The bones of the metacarpus are sometimes broken. I have known them fractured in pugilistic contests. The accident is readily known from the crepitation perceived at the place of fracture by careful examination. The treatment consists in filling the palm of the hand with a compress, and applying a straight splint in front, extending from just below the elbow to the ends of the fingers.

The bones of the fingers are also sometimes broken. All the different phalanges are liable to fracture. The accident is known by the change of shape in the finger, and by the motion at the fractured part, which is attended with evident crepitation. The reduction is easily effected, and is to be maintained by a narrow roller passed round the finger, and by two firm pasteboard splints, one before, and one behind wider than the finger and bent a little round it, which are to be secured by the same roller. I have found it useful to prevent the motion of the fingers and hand by a firm splint, long enough to reach from the middle of the fore arm to the finger ends. In about four weeks the union is generally completed.

" When a very heavy body has crushed the extremities of the fingers, or when they have been bruised by a folding door, the soft parts are generally lacerated, the nail torn off, and the last phalanx fractured and denudated. If in such cases, the parts hold together by a shred of a certain thickness, and which contains vessels enough for the nourishment of the phalanx, the reunion of the parts should be attempted. The prospect of success it is true, is not great in most cases, but if our endeavours to save the finger fail, amputation is still as much in our power, as in the commencement.

"If the last phalanx alone is crushed, it will be better to amputate at once, than attempt to save the joint. The cure would be difficult and tedious, on account of the exfoliation that would take place. Besides the part being deformed, instead of being useful, would be troublesome. By amputating at the articulation with the second phalanx, a simple wound is substituted to the ragged and lacerated wound, produced by the cause of fracture. This will heal in a very short time, if care be taken to preserve a sufficiency of skin to cover the surface of the articulation." (BOYER.)

CHAPTER XXIX.

Fractures of the Thigh.

The os femoris is very frequently broken, and it is of great importance to treat the accident in such a manner as to prevent deformity and lameness, which are often its consequences.

The thigh bone may be broken at the head, even within the acetabulum; at the neck, at the condyles, and at any part between the neck and condyles. The great trochanter is in some cases, knocked off from the rest of the bone. The fracture is sometimes *transverse,* sometimes *oblique,* sometimes *comminuted,* sometimes *compound;* but most commonly we find it, a simple oblique fracture.

A fracture of the os femoris is attended with a mobility at the fractured part, an inability to stand on the limb, or to move it without extreme pain at the fracture; generally with a very distinct crepitation when the fragments are moved against each other, and almost in every instance with deformity and shortening of the member.

Mr. Boyer observes, that "the numerous muscles of the thigh by means of which derangement may be effected, are divisible into three classes, relative to the manner in which they tend to effect it. The three portions of the triceps femoris are attached to both pieces, and tend to produce the angular derangement by drawing the two fractured portions to a salient angle on the outside, where their fibres are strongest and most numerous. The biceps femoris, semitendinosus, semimembranosus, sartorius, rectus internus, and third adductor, all those in short, which extend from the pelvis to the inferior portion, or to the leg with which it articulates, tend to draw the inferior portion upward, on the internal side of the superior, the extremity of which forms a tumour on the external side of the thigh. The inferior portion is that which is always displaced, except when the fracture takes place immediately under the small trochanter, to which process are attached, by a common insertion, the psoas and iliacus muscles; which muscles would, in such a case, draw the superior portion upward and forward, producing by that means a tumour in the groin.

When the femur is fractured immediately above the condyles, the inferior piece is drawn backward, and its superior surface turned downward by the action of the gastrocnemius externus, plantaris, and popliteus muscles. When the great trochanter is detached from the rest of the bone, it is drawn upward by the muscles which are inserted into it, but without producing any change in the direction or form of the thigh.

The angular derangement in which the foot inclines, either inward or outward, is the effect of the weight of the foot or of the bed-clothes, rather than of muscular contraction."

Transverse fractures are less liable to displacement, and are more easily retained in their natural position than oblique, for very obvious reasons, the opposing surfaces supporting each other to a certain extent.

Fractures of the os femoris are more difficult of cure than those of any other limb; and such was formerly the want of success in preventing deformity that the ancients considered it impossible to cure them without shortening of the thigh, and Mr. John Bell, notwithstanding his high notions of modern surgery declares, that "the machine is not yet invented, by which a fractured thigh bone can be perfectly secured." A position which, though entirely false, proves that surgeons consider the fracture of a very serious nature.

Before proceeding to detail the practice I wish to recommend in the treatment of fractures of the os femoris, it may not be amiss to premise, that surgeons have been greatly divided in their opinions respecting the posture in which the patient should be placed during the cure.

The celebrated Mr. Percival Pott, was a warm advocate for a bent position, and recommended the thigh to be bent upon the pelvis, and the leg upon the thigh, and the patient to be laid upon his side, under an idea, that in this manner the muscles would be most completely relaxed, and thus the great cause of deformity obviated. The British surgeons have pretty generally followed this practice.

The late French writers, and particularly Desault and Boyer, have strenuously recommended a contrary practice, placing the patient on the back and extending the lower extremity; the reasons which induced them to reject Mr. Pott's plan, Desault states to be "the difficulty of making extension and counter-extension, with the limb thus situated; the necessity of making them on the fractured bone itself, and not on a part remote from the fracture, such as the lower part of the leg; the impossibility of comparing the broken with the sound limb; the uneasiness occasioned by this position if long continued, though at first it may appear most natural; the troublesome and painful pressure on the great trochanter of the affected side; the derangements to which the fragments are exposed when the patient goes to stool; the difficulty of fixing the leg with sufficient steadiness, to prevent it from affecting the os femoris by its motions; *the evident impracticability of this method when both thighs are broken*, and finally experience, which in France has been by no means favourable to the position recommended by Pott."

Mr. John Bell, with all that copia verborum which characterizes his truly peculiar style, and with all that violence, with which he opposes every thing he fancies wrong, has devoted several quarto pages of his Principles of Surgery to an abusive opposition of the practice of Desault, whose theory he pronounces "unworthy his high character," and asserts that "his intentions, and indeed his very words, are anticipated not merely by old surgeons whose works he might have neglected to read, but by his immediate predecessors and cotemporaries, Petit, Sabatier, and Duverney." Mr. Bell declares, that Desault's plan "is neither original nor successful," and that "the napkin round the thorax produces oppression and insufferable distress which no one can possibly bear." Mr. Bell in this and many other passages proves incontestibly that he never saw Desault's apparatus applied; that he is entirely ignorant of it, and that in this, as in several other instances, he writes and rails on a subject he does not comprehend. In proof of this, I shall quote the following passage, which strongly evinces his want of candour, and his want of correct information.

"To judge of the merits of these methods, *imagine* to yourselves the condition of a patient under Desault's discipline; *first laid down on one side* and bound to the long splint of Duverney that the body and the limb were as one piece; next a great napkin put round the thorax with all the firmness of a bandage; straps going round the thorax, passing under the arm-pits fixed to this circular, and the patient drawn up by these straps to the head of the bed. Next *imagine*, two lacs or long bandages, fixed one round the knee the other round the ankle, one tightened when the other had caused excoriation; *imagine* the patient, extended like a malefactor drawn by horses, bound so down to the bed, that even a cloth or flat dish could not be slipped in under him; the bands assiduously tightened the moment they seemed to relax, and the *thorax so bound and compressed that he could not breathe*; think of all this apparatus of bandage if you can, without holding in your breath, as if trying whether such oppression could be endured. I think for my share, I could as well undertake to live under water, as in Desault's, I might say Damien's bed." When the reader has finished this rhapsody, let him *imagine* something precisely opposite to what Mr. Bell has *imagined*, and he will have some idea of Desault's apparatus.

How far Desault or Damien, are to be considered as authors of this *imaginary* apparatus of Mr. Bell, a perusal of their writings will show; but it is truly astonishing that after such gross perversions, Mr. Bell should have the effrontery to add, that he has quoted his histories of the various machines "in the very words of the inventors, because it is the only fair and impartial representation."* Mr. Bell knew what *would have been* impartial; and yet far from quoting Desault's "*very words*," his whole object has been to misrepresent them.

I should owe an apology for this digression if the object were less important, but I am solicitous that *students of surgery* should not consider the *sophistries of Mr. John Bell* as logical arguments.

I should next proceed to state the advantages of the straight position in fractured thigh, but having quoted them from Desault, I shall simply detail the mode of treatment which I consider best adapted to the accident, and which is a modification of that proposed by Desault, just premising that although volumes have been written on the action of the muscles in occasioning derangements of the fragments, it is a certain truth which has been too much overlooked by all writers, that the muscles very speedily accommodate themselves *to any posture,* and that therefore, that one should be chosen, which is most favourable to the healing of the fracture and the convenience of the patient, and this for many reasons which I shall not detail in this place (but the chief of which is the experience of the surgeons in the Pennsylvania hospital and in the French hospitals,) I believe to be the straight position.

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* John Bell—Principles of Surgery, Vol. I.

The bed should be prepared and the dressings disposed on it before the patient is placed upon it. If sir James Earle's bed, cannot be procured, a hair mattress may be placed upon a common bedstead, but boards or strips of wood should be substituted for the sacking bottom; across this mattress, five or six pieces of tape should be laid; over the tapes a piece of muslin a yard in width, and a yard and a half long (if the patient be an adult;) over this "splint cloth" a splint of pasteboard nine inches long and two wide is to be placed at its upper end, and a bandage of strips long enough to extend from the knee to the groin, is to be laid over this splint; each strip should be of muslin, two inches wide, and long enough to pass round the thigh, and overlap several inches. In arranging these strips, the one which is to be last applied to the thigh, must be the first laid down, and this will be the upper one, which should be rather longer than the rest, because the thigh is thickest at its upper part; each succeeding strip is to cover one-third part or half of that which preceded it. The next things to be provided, are two bags of chaff, or finely cut straw, four inches wide and long enough to extend from the hip to the foot; if these cannot be obtained, flannel or tow may be used as compresses, in lieu of them. A silk handkerchief, or a strong band of soft linen, is to be placed at the top of the splint cloth for counter-extension, and a similar one is to be provided for making extension at the ankle. Two long splints are to be procured, made of light wood; the first, which is that of Desault, improved by Dr. Physick and Dr. Hutchinson, should be so long as to extend from the axilla six inches below the foot; it is formed like a crutch at its upper extremity, and a block projects from near its lower end, the use of which will be presently noticed; two holes are formed near the upper extremity, and one near the lower, through which the counter-extending and extending bands are passed; the second long splint is three inches wide above, and tapers to two and a half below, and long enough to reach from the perineum to the end of the longest splint; a fourth splint, of the same dimensions and materials as the first, completes the apparatus.

The patient is now to be placed carefully on his back on the mattress, in such a manner that the injured thigh may be situated upon the bandage of strips. The band for counter-extension is now passed along the perineum, and between the scrotum (or labium pudendi) and the affected thigh, and is delivered to an assistant. The band for extension is passed round the ankle, tied under the foot and delivered to another assistant; by pulling these bands extension is made, and the surgeon replaces carefully the fragments in apposition, and then applies the bandage of strips, beginning at the knee and proceeding upward to the groin. The two long splints are now folded up in the splint cloth so that both splints may apply neatly to the sides of the limb; the bags of chaff, or compresses are interposed to fill up the spaces occasioned by the inequalities of the leg and thigh, and the two extremities of the bands for counter-extension are passed through the two holes near the upper end of the splint and tied firmly; care being taken not to permit the displacement of the fragments whilst this is done. The band for extension is next passed through the hole at the lower end of the splint, and tied; but great caution is to be used in this stage of the business, to avoid, on the one hand, drawing the bandage too tight, and on the other, relaxing it so as to suffer the fragments to pass each other. All that now remains is to apply the fourth splint on top of the thigh, and secure it by three tapes, which will bind all four of the splints moderately tight upon the thigh, and to secure the lower extremities of the two long splints by two or three tapes between the knee and ankle. A bandage or handkerchief may now be passed round the pelvis, to assist in fixing the patient at rest, and this bandage will certainly be found to exert no mischievous effects on the organs of respiration.

The use of the posterior pasteboard splint, is chiefly to prevent the tape passed round the thigh from irritating the skin, and also to assist in gently compressing the muscles of the thigh and supporting equably the fragments of the bone behind.

The principal difference between the mode of dressing a fractured thigh, just described, and that recommended by Desault, consists in the increased length of the splint by which the permanent extension is kept up; an improvement which was first made by Dr. Physick.

In the first of the annexed engravings, Desault's apparatus is represented, and in the second the improvements that have been introduced by Dr. Physick, which certainly give to the apparatus some important advantages. In the first place, the splint of Desault being but little longer than the limb, the strap or band for counter-extension passes over the upper part of the os femoris at an oblique angle, and has a strong tendency to draw the superior fragment of the bone outwards; whereas in the splint contrived by Dr. Physick, the mortise hole being cut high up near the axilla, the band for counter-extension acts upon the pelvis, in a line nearly parallel with the natural direction of the limb, and has no tendency to any lateral displacement of either fragment. In the next place, by extending the splint as high as the axilla, the pressure of the end of the splint does not injure the patient's hip. The crutch-like form is intended to prevent the extremity from rubbing against the patient's side, and it is to be covered with soft flannel or linen, to defend the axilla.

Dr. Physick having in some cases found that when considerable force was applied to the extending band, the foot was pulled outward and pressed against the splint so as to occasion excoriation, and finding the use of compresses and the chaff bags inefficient in preventing this inconvenience, suggested to Dr. Hutchinson, then a student at the Pennsylvania hospital, the advantage of some contrivance to obviate it. He accordingly attached to the lower end of the splint a block, projecting two or three inches from the inside of the splint, across which the band for extension is carried to the mortise hole at the lower end of the splint. The splint being thus constructed, the extension is also made more completely in the direction of the limb.

By the use of this apparatus there can be no doubt that "permanent extension" of the thigh bone, notwithstanding the cavils of Mr. J. Bell, may be kept up, and that a perfect cure may in most cases be effected, without the slightest evident deformity, or shortening of the limb. I have for twelve or fourteen years witnessed the effect of this mode of treatment in the Pennsylvania hospital, where more accidents are admitted than in any other institution in America, and I am safe in asserting, that the success of the practice has been surpassed by that of no other hospital in the world. I have never seen a crooked limb, or a shortened limb, the consequence of a simple fracture of the thigh, unattended by comminution, where Desault's apparatus, modified as above, has been fairly applied.

It is proper, however, to remark, that some practitioners have become dissatisfied with this mode of treatment in consequence of the excoriation which they have found to take place at the perineum and at the top of the foot. In answer to this objection it must be stated, that the use of "*permanent* extension" does not imply *violent* extension, nor *sudden* extension, but simply a long continued resistance to the contraction of muscles which would if unresisted, shorten the limb. In order to effect this, after the dressings are applied, it is proper in every instance, if any pain is experienced, either at the foot or perineum, to loosen the extending band. Most of the inconveniences attributed to the method of Desault have arisen from its improper application, and nothing is more improper, than to make violent extension during the existence of the irritation and inflammatory symptoms which succeed to a fracture of the os femoris. The extending bandages ought always to be very moderately tense, during the first three or four days after the accident, and afterwards they should be gradually tightened, the limb being examined from day to day, and its comparative length with its uninjured fellow, distinctly ascertained. If the patient experience any difficulty in bearing pressure upon the top of the foot, a piece of buckskin with holes in front may be laced round the ankle, and straps attached to this afford a very convenient substitute for the handkerchief with which the extension is made. In warm weather, and in emaciated persons this gaiter of buckskin is extremely useful.

By observing these precautions, very little difficulty will be experienced in the treatment of fractures of the thigh bone near its middle. Six or eight weeks are generally necessary for the reunion of a fractured thigh bone.

Compound fractures of the body of the os femoris require no difference of treatment from other compound fractures, but the dressings necessary for the external wound may be very conveniently applied, without interfering with the long splints.

When both thighs are broken, or when one thigh is fractured in several parts, no plan of treatment is comparable with that by permanent extension. I have had occasion to apply it in the case of a miller's wife who was caught in some machinery; which fractured both her thighs and one leg below the knee. She was placed on her back, and the dressings which have been recommended, were applied; she recovered as happily as if only one fracture had existed, experiencing very little more pain, fever or inconvenience, than is usual in simple fractures of the thigh or leg.

It has been proposed among other methods of preserving a bent position, to place the patient on his back with an angular box under the knee. I have known this plan used, and much difficulty was experienced in preventing the rotation of the limb, every motion of the pelvis, occasioned motion at the fracture, and the surgeon who attempted it, laid it aside.*

FRACTURES OF THE GREAT TROCHANTER are the effect either of falls on that protuberance, or of the action of bodies striking against it. They are either oblique, or transverse, situated sometimes at its summit, and sometimes at its base.

This accident may be distinguished, by a facility of moving the great trochanter in every direction, while the pelvis and the thigh remain without motion; by a crepitation, arising from the friction of the divided surfaces against each other; by their being no shortening of the limb, when the fracture exists alone: by the fragments being brought together in abduction, and separated in adduction; by the position of the great trochanter being higher and more anterior than natural. The presence of these signs are more readily perceived, because, being superficially situated, this protuberance can be easily felt, and yields to the motions impressed on it.

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* Something of this kind has been recommended by Mr. Charles Bell. Operative Surgery, Vol. II. page 190.

The reduction is effected, by pushing the separated fragment in the direction opposite to that of its displacement, by bringing it to its natural level, and, in certain cases, by moving the thigh a little outwards; it is retained by means of some compresses placed by its sides, and secured by a roller directed obliquely from the sound hip towards that part of the thigh corresponding to the fracture.

FRACTURES OF THE NECK OF THE OS FEMORIS are not so frequent as those of the body of the bone, but they do occasionally occur; the fracture is generally transverse, occurs at every part of the neck of the bone, sometimes completely within the capsular ligament, so that the round ligament, constitutes the only connexion which the upper fragment has with the body. As this accident has some symptoms in common with certain dislocations of the os femoris, it is of great importance to discriminate this accident from all others. Desault states the following as the best diagnostic symptoms. "At the time of the fall a sharp pain is felt, sometimes a noise is distinctly heard, a sudden inability to move the limb occurs, and in general the patient cannot rise, this last circumstance, however, is not uniform; a case is recorded in the fourth volume of the Mem. Acad. Surg. where the patient walked home after the fall, and even rose up the following day. Desault also saw examples of this peculiarity. The interlocking of the fragments is the cause of it.

A shortening of the limb almost always occurs, more or less perceptible, according as the extremity of the fragments are retained by the capsule, or as the division, being without the cavity, no resistance is made to their displacement. The muscular action drawing the lower fragment upwards, and the weight of the trunk, pushing the pelvis and superior fragment downward, are the causes of this shortening. A slight effort is in general sufficient to remove this shortening, which, however, soon returns when the effort ceases. A tumefaction appears in the anterior and upper part of the thigh, almost always proportioned to its shortening, of which it appears to be the effect.

The projection of the great trochanter is almost entirely removed. That protuberance being directed upward and backward, is approximated to the spine of the ilium. But if it be pushed in the opposite direction, it readily yields, and then returning to its proper level, allows the patient to move the thigh.

"The knee is a little bent. A severe pain always accompanies the motions of abduction, when they are communicated to the limb. If, while the hand is applied to the great trochanter, the limb be made to rotate on its axis, this bony protuberance is perceived to turn on itself as on a pivot, instead of describing, as it does in its natural state, the arch of a circle, of which the neck of the os femoris is the radius. This sign, which was first observed by Desault, is very perceptible, when the fracture is at the root of the neck; less, when it is in the middle, and very little, when it exists towards the head of the bone: these are circumstances the cause of which it is unnecessary to unfold. In rotatory motions, the lower fragment, rubbing against the upper one, produces a distinct crepitation, a phenomenon which does not always occur.

"The point of the foot is usually turned outwards; a position which Sabatier, Bruninghausen, and most other practitioners, regard as a necessary effect of the fracture; although Ambrose Parey and Petit have borne witness that it does not always exist. Two cases, reported on this subject, by celebrated surgeons, have been thought unfounded by Louis, who has attributed them either to an error in language, or a mistake of the transcriber. But the practice of Desault has fully confirmed their possibility. The first patient whom he had under his care, at the hospital of Charity, after he was appointed surgeon in chief, laboured under a fracture which presented this phenomenon. Many other examples occurred to him afterwards, and he believed it might be laid down as an established principle, that, in fractures of the neck of the os femoris, the direction of the foot outwards is to that inwards as eight to two.

"The common opinion is, that this direction outwards, is to be attributed to the muscles that perform rotation. But, were that the case, 1st, it is evident that it would always exist: 2dly, all the muscles running from the pelvis towards the trochanter, except the quadratus, are in a state of relaxation, in consequence of the approximation of the os femoris to their points of insertion: 3dly, muscles in a state of contraction would not allow the point of the foot to be drawn so easily inwards. Is it not more probable, that the weight of the part draws it in the direction in which it is usually found.

"From the foregoing considerations, it follows, that none of the signs of a fracture of the neck of the os femoris, is exclusively characteristic, that the whole of them, taken separately, would be insufficient, and that it is their assemblage alone, which can throw on the diagnosis that light which is oftentimes wanting to it, even in the view of able practitioners. But after all, in the present case, as in every other one, should any doubt exist, it is right to take the safe side, and apply the apparatus, which is indeed useless, but not dangerous, if the fracture does not exist, but indispensably necessary if it does." (DESAULT.)

A concise abstract of the symptoms enumerated by Boyer will aid the student in distinguishing this fracture. A fall or blow on the trochanter or feet, is generally the cause; it is followed by pain in the articulation, an impossibility to bend the thigh; shortness of the limb, which is easily removed, but returns when the extension is discontinued; an inclination of the foot and knee outward, with great facility of moving these parts to their natural situation; crepitation produced in different movements; and the smallness of the circle in which the great trochanter moves in a rotatory motion. We can seldom be mistaken as to the existence of this fracture, if we attend to all these circumstances.

Of all fractures of the os femoris, those of the neck are most tedious in healing, and attended with most danger of lameness and deformity. Some surgeons imagine, that bony union never forms between the fragments; but many proofs exist that this opinion is erroneous, and preparations in different anatomical collections shew instances of bony reunion of the neck of the thigh bone. It is always, however, slower in its formation, and in many instances does not at all take place, the patient remaining incurably lame.

Instances of recovery in old persons are not frequent, and Boyer considers the fracture "after a certain age" incurable; but he adds "it is not in our power to mark precisely the period beyond which a cure is not to be hoped for. To be able to settle this, it would be necessary that the effects of old age were uniform in every individual, and that the degree of senility were always commensurate with the number of years. Lèsne shewed at the Academy of Surgery, the femur of a woman aged eighty-nine, with evident marks of a consolidated fracture of its neck." Boyer himself, saw a patient in which the consolidation of a double fracture was considerably advanced in a man eighty-three years old. Numerous facts of this nature, authorize and require the application of the apparatus in all cases, except where the patient reduced to the last stage of decrepitude and debility cannot support its weight, or is attacked by some mortal disease. But at the same time the surgeon should for his own sake, acquaint the patient and his friends with the uncertainty of the cure, in order to ward off any imputation that might be made in case of failure.

Many respectable surgeons have positively asserted that a recovery without lameness and shortening is impossible. Desault and Boyer on the contrary, both relate instances in which they were completely successful.

The fracture is easily reduced by making counter-extension at the arm-pits, an assistant holding the patient under the arms, and extension by drawing down the foot until the limb resumes its natural length and appearance, it is not easy, however, to secure the fragments in contact, but the apparatus of Desault promises to be more successful than any other plan heretofore in use for that purpose. The long splints are to be applied precisely as in fractures of the body of the os femoris, but no bandages of strips, or pasteboard splints are required in this case, as the permanent extension is alone necessary, and they would be useless as they would act only on the inferior fragment.

The fracture healed in one case recorded by Desault, in sixty days, but generally three months are required for the consolidation. During this time the apparatus should be examined daily, and tightened from time to time, if any shortening of the limb is observed. Stiffness of the joint is not a frequent consequence of this accident.

When the permanent extension cannot be applied, from the extreme age of the patient, or any other cause, great care should be taken to prevent the motions of the fragments, by long stiff splints bound firmly on the pelvis, and extending below the foot. In this manner a cure will be effected, but probably the detached neck of the bone will adhere to a portion, considerably below the trochanter, and thus the limb will be shortened.

In a case of fracture of the head of the os femoris which occurred in a gentleman of Philadelphia, permanent lameness ensued, and no union of the fragments took place, he died some years after, and upon examining the hip joint, a singular instance of the resources of nature was presented to view. A ledge of bone was observed projecting from the trochanter, and upon this the acetabulum rested, and thus some weight was sustained by the os femoris—it was in fact, an attempt to regenerate a neck and head for the bone in a situation where it would have been useful, and have enabled the patient to walk, had he lived until it was completed. He never was able after the accident to bear much weight on the affected side. The bone is now in Dr. Physick's possession.

Fractures of the lower extremity of the os femoris unless they are situated within the joint, call for no peculiarity of treatment, but are to be managed just as when they occur higher up in the bone.

Sometimes, however, the fracture detaches a portion of one condyle from the rest of the bone (Fig. 5.) Sometimes a fracture separates the condyles from each other, and both from the rest of the bone by a double fracture, analogous to that which occurs in the lower end of the humerus, as in Fig. 4.

The fracture in which the condyles are thus separated from the os femoris may be known, by a perceptible separation, increasing the width of the knee. The patella sinking into the chasm between the condyles, renders the part flatter than natural: if the patella be pressed backwards the condyles are still further separated: if on the contrary, pressure be made on the sides of the knee, the knee resumes its usual breadth and appearance: by moving the fragments, crepitation may be heard. Where only one condyle is detached, it can be felt moving under the fingers, and producing crepitus when rubbed against its fellow.

Sometimes this accident is complicated with a lacerated wound, from the bone being forced through the skin, or from the cause of the accident penetrating to the cavity of the fracture, and of the joint, thus producing a compound fracture, with an exposure of the joint: a terrible accident, attended with all the dangers resulting from lacerated wounds of the larger joints, and demanding the same mode of treatment, with the additional measures necessary for maintaining in contact the fragments of the bone.

The treatment necessary in these cases, varies according to their circumstances. If a fracture exist an inch above the knee joint, and this fracture be attended with a shortening of the limb, (which will be the case if it be an oblique fracture,) and if in addition to this, a second fracture separates the condyles extending to the first, as in Fig. 4. In this case the permanent extension is to be applied, as in fractures of the body of the thigh bone with the omission of the pasteboard splints, this will prevent the upper fracture from displacement, and in order to keep the condyles in contact at their fractured surfaces a roller or bandage of strips must be applied, reaching from the ankle to the middle or upper part of the thigh, and applied pretty tight at the knee.

If the upper fracture be transverse, no necessity exists for permanent extension, and therefore simple pasteboard splints may be applied, or the long splints as in the preceding case, omitting to apply the extending force. The lateral pressure is in these cases the chief indication, and to prevent the foot and leg from swelling, a roller should be applied from the foot to the knee. The usual antiphlogistic remedies are to be employed if inflammation run high, and the apparatus must be kept on eight weeks before any motion is attempted; as soon as the parts have united firmly, the limb must be gently and repeatedly moved, to prevent false anchylosis, or stiffness of the joint. The patella should be moved frequently, and the posture of the leg whilst at rest, often varied.

EXPLANATION OF THE PLATE.

Fig. 1. Represents a fracture of the head of the os femoris.

Fig. 2. A fracture of its neck.

Fig. 3. A common oblique fracture near the middle of the bone.

Fig. 4. A fracture at the lower extremity of the bone, in which the condyles are detached from the body of the os femoris and from each other.

Fig. 5. Shews several directions *a*, *b*, *c*, *d*, in which the different condyles are occasionally fractured.

Fig. 6. Represents the relative situation of the fractured ends of the bone in the cases mentioned in page 128, in which the seton was unsuccessfully tried for the cure of an artificial joint. The dotted line shews the course of the seton, which passed through an indurated mass of flesh, and did not come in contact with the bone. From this view it is evident, that in such cases, the seton cannot be successfully used.

PLATE VI.

Fractures of the Thigh.

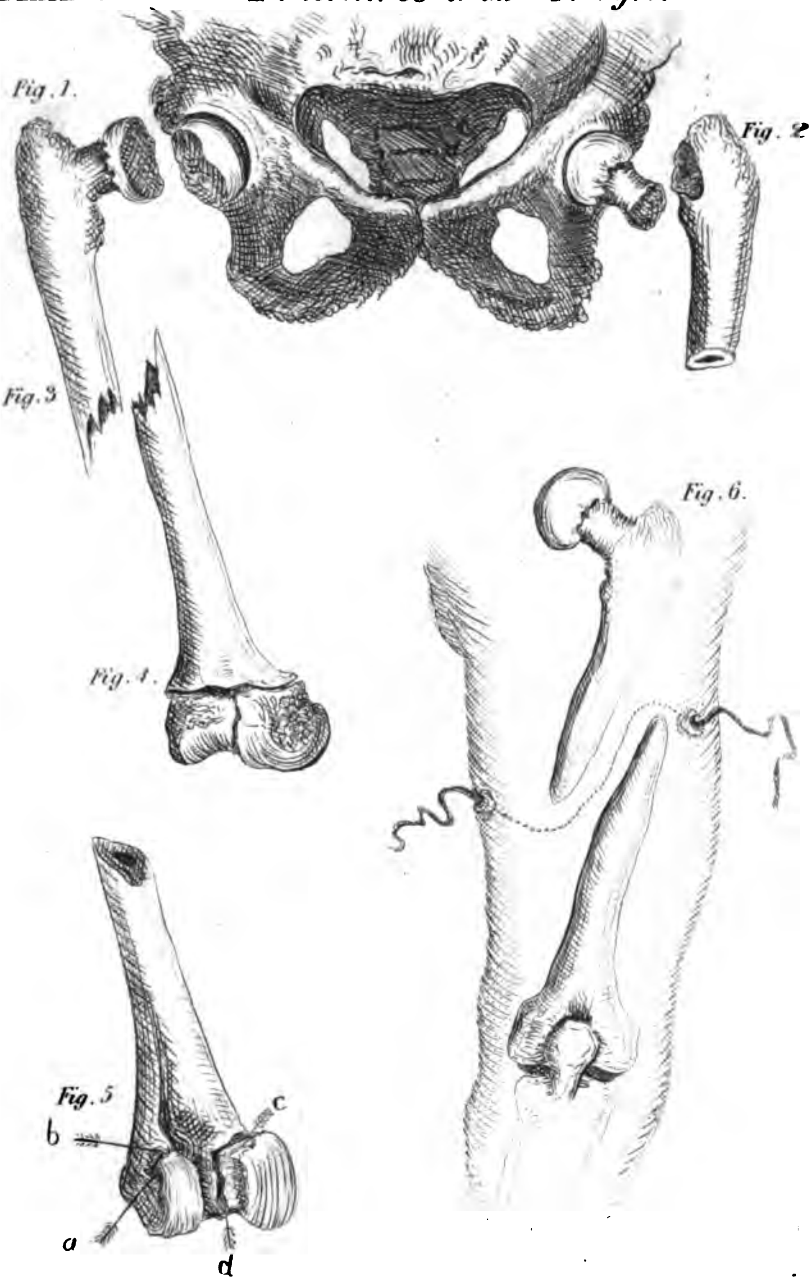
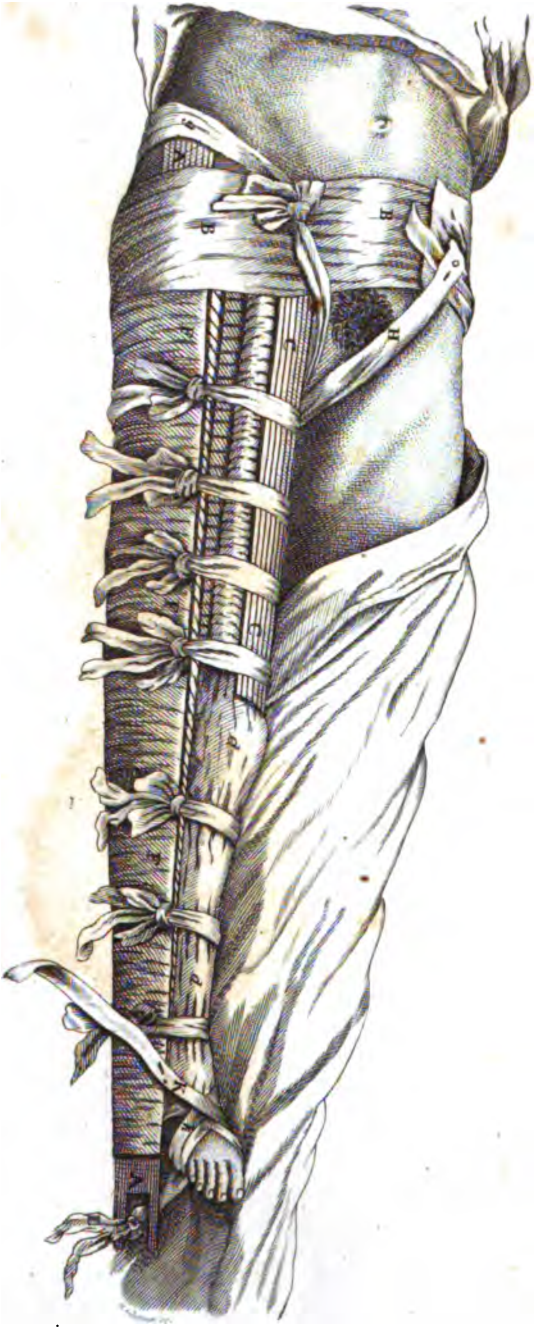


PLATE. VII.



EXPLANATION OF THE PLATE.

The opposite engraving represents the apparatus for permanent extension, employed by Desault in oblique fractures of the os femoris.

AA. The external splint, with a notch and a mortise at the lower end to fix the inferior extending roller.

BB. A bandage passing round the body, intended to secure this splint against the pelvis.

CC. The anterior splint, reaching only to the knee.

d. d. d. d. The anterior bolster, extending along the whole limb, and secured by pieces of strong tape.

EE. A portion of the bandage of strips, seen between the anterior and the external lateral bolsters.

FF. The junk-cloth intended to be folded round the two lateral splints.

g. g. The superior extending roller, passing round the end of the external splint, and fixed underneath on the tuberosity of the ischium.

H. The sub-femoral roller or strap, intended to prevent the bandage BB, which passes round the body, from slipping upwards.

K *k*. A roller usually passed round the foot, to prevent it from turning.

L. The inferior extending roller, fixed in the mortise and the notch of the external splint.

EXPLANATION OF THE PLATE

Representing Dr. Physick's modification of Desault's apparatus.

AA. Dr. Physick's long splint.

B. A block fastened near its lower end, projecting at right angles from the splint, over which the extending band passes and is tied at the mortise C.

D. The crutch-like extremity fitted to the axilla.

E. The edge of the inner splint which extends from the perineum below the foot.

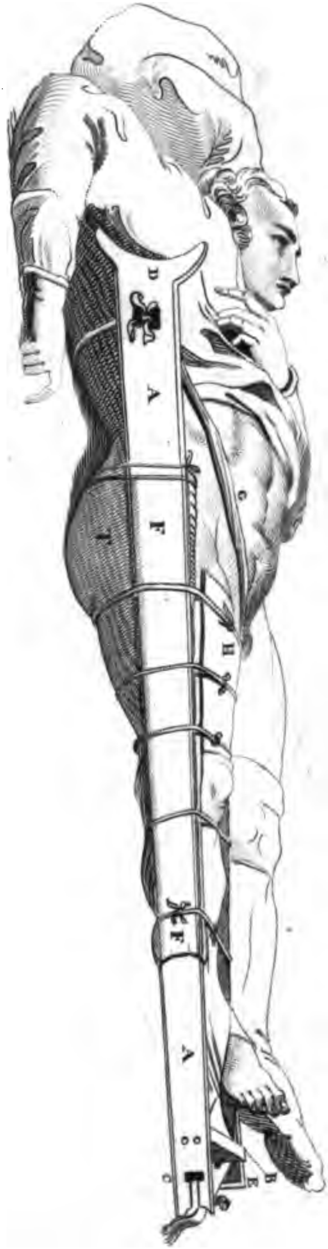
F. The splint cloth wrapped round the external and internal splints.

G. The counter-extending band passing under the tuberosity of the ischium, and secured at the mortise, at the upper end of the splint.

H. The anterior splint of pasteboard (a similar one is placed on the back part of the thigh.)

The bandage round the pelvis is omitted to prevent confusion.

PLATE VIII.



CHAPTER XXX.

Fractures of the Patella.

These may be longitudinal, transverse, or oblique; but in general they are transverse. They are occasioned by falls, blows, and accidental violence, and also in some cases by the exclusive action of the extensor muscles of the leg: of this many instances are recorded. I have myself met with two, one of which occurred in a rider at the circus, who in vaulting into his saddle from the ground whilst his horse was in full speed, suddenly fell, without knowing the cause; a sharp pain at the knee informed him of the seat of the injury. Upon examination, I found the patella fractured transversely, and the upper half, drawn to a considerable distance from the lower.

It sometimes, though very rarely happens, that the tendon above or below the patella is fractured, and not the bone. The mode of treatment are in both cases precisely similar.

A fracture of the patella is readily distinguished. If it be transverse the patient cannot extend the leg, he generally falls and is unable to rise; though sometimes he gets up, and by dragging the limb sideways, is even able to walk, taking great care not to bend the knee. A depression at the place of fracture is perceived, and commonly, the superior fragment is found at a considerable distance from the inferior, which being tied firmly to the tibia, cannot move upwards. The longitudinal and oblique fractures can be known by examination with the fingers, as the bone is very thinly covered.

It has been a matter of doubt among surgeons whether bony reunion ever takes place between the fragments of a broken patella. When the distance between them is considerable, a firm ligamentous or tendinous matter connects them, and the motion of the joint after a time is regained. When, on the contrary, they are kept in close contact, the union is hard, firm, and unyielding; whether it is bone, tendon, cartilage or ligament, is an object of more curiosity than utility.

The great object to be attended to in the treatment of fractures of the patella, is to preserve the fragments as nearly as possible, in apposition, so that the substance connecting them may be rendered as short as possible, and the motions of the joint be perfectly preserved.

Whenever the fracture is occasioned by a violent blow, and great contusion is produced by it, there is reason to apprehend inflammation and swelling of the knee, in which case bleeding and the usual remedies for inflammation are to be employed. The local treatment consists in keeping the limb at rest in an extended posture, and by a splint and bandages preserving the contact of the fragments. The chief obstacle to be encountered, is the action of the extensor muscles; and this is easily overcome, by the application of a stiff splint behind the limb secured by a roller.

A variety of machines have been constructed for the purpose of preserving the permanent extension of the leg, and most of them answer very well. I have always employed a very simple one. It consists of a piece of wood half an inch thick, two or three inches wide, and long enough to extend from the buttock to the heel; near the middle of this splint, two bands of strong doubled muslin a yard long, are nailed, at a distance of six inches from each other. Upon this splint, covered with compresses of soft flannel or linen, so as to fill up the inequalities of the limb, the patient's leg and thigh are placed. An assistant now raises the heel, and the surgeon applies a bandage (a common muslin roller, two inches wide, and eight or ten yards long,) commencing at the ankle, and proceeding to the knee; he carefully draws down the upper fragment of the bone as nearly as possible to the lower one, and places a compress of folded linen above it; several turns of the bandage are now made over this compress and obliquely under the knee, in such a manner as to cross below the lower and above the upper fragment alternately, in the form of the figure 8; the bandage is then carried on to the top of the thigh and brought down over the splint, leaving the band attached to it, free. Care must be taken to cover every part of the skin with the roller, because any part which is not thus supported will swell and inflame. After the dressing has proceeded thus far, the bands of muslin are to be used for the purpose of more completely fixing the fragments; the lower one is to be passed round the thigh above the upper fragment, and vice versa, the upper strap passed below the lower and secured by a pin or knot. These bands will thus enable the surgeon to exert any requisite compression upon the fragments without the inconvenience of moving the bandage or splint.

It is evident that this apparatus is in principle the same as Boyer's. I claim no merit for its construction, but one advantage it certainly possesses; it may always be procured in a few minutes, as a shingle or strip of wood and a couple of nails are the only materials necessary for its formation; and this in country practice is an object of no small importance. I have never employed any other mode of treatment, in the cases of this accident which have fallen under my care, and in all these, it has completely answered my expectations; the union of the fragments has taken place very quickly and in two cases without any perceptible interval or motion between them. The patient must be kept lying on his back on a mattress and from day to day the bands are to be examined, and tightened if necessary. Boyer directs the joint to be moved after the twenty-fifth day, to prevent stiffness. These motions, if commenced so early, should be very gentle, but they may safely be delayed until the fourth or fifth week. In six or seven weeks the union is generally completed.

CHAPTER XXXI.

Fractures of the Leg.

The tibia and fibula are sometimes broken singly and sometimes both are fractured. The fracture may happen at any part between the knee and ankle. The fracture of both bones is most frequent; it may be transverse or oblique, simple or compound, comminuted or single. The fragments are occasionally displaced in every direction. In transverse fractures, there is generally no shortening of the limb, but in those which are oblique, the leg is generally shortened: patients have been known to walk many steps without great inconvenience, after having fractured the tibia transversely, in consequence of the want of derangement.

Fractures of the leg are characterized by the general symptoms of fracture. Deformity of the member; loss of power to move the limb; great pain at the time of fracture, and on every motion of the part, crepitation, &c.

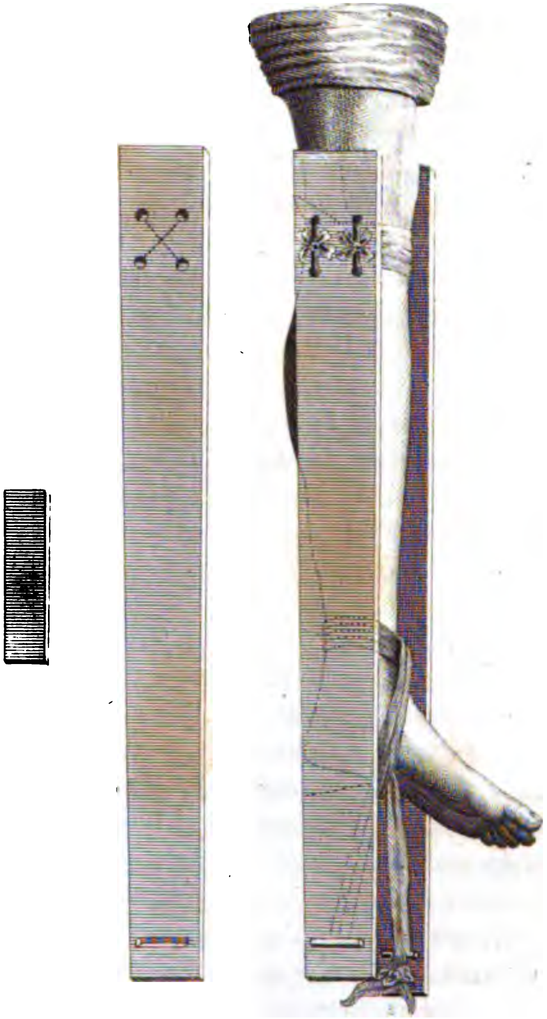
The higher up the fracture is situated, in general, the more favourably does it terminate: very little danger of derangement exists when the upper extremity of the bones are broken, as the bulk of the tibia at this part, affords large opposing surfaces, which support each other, and prevent displacement. Oblique fractures of both bones of the leg it is sometimes very difficult to manage; they are attended with great inflammation from the irritation of the sharp fragments.

The treatment varies according as the fracture is transverse or oblique. A transverse fracture, is very easily reduced and maintained in its proper situation. One assistant grasps the knee, and another the foot, extension and counter-extension being made, the surgeon replaces the fragments, and judges of this by the deformity ceasing, and by the regularity of the anterior edge of the tibia, which is so thinly covered as to be easily felt.

A roller is now to be applied, (or a bandage of strips,) very neatly from the ankle to the knee: two pasteboard splints soaked in water, are placed one on each side of the leg, they should extend from the knee to the sole of the foot, in order to confine and prevent the lateral motions of the foot at the ankle joint. Over these splints a second roller or bandage of strips is to be applied; the splints soon become dry and form a solid case for the limb which supports sufficiently the fractured bones. It is necessary to avoid bandaging too tight, and to loosen the dressings if inflammation render them so, by augmenting the volume of the limb: an observation which is applicable to most fractures and should never be neglected. The limb is now laid on a pillow, the patient being placed on a mattress on his back, two strips of wood as long as the pillow, and three or four inches wide, may be tied with tapes on the outside of the pillow and answer the purpose of a fracture box; the weight of the foot should be supported by a bandage passed round the toes, and fastened to the boards on the outside of the pillow. The weight of the bed clothes should be sustained by some simple contrivance, as the segments of two hoops tied together. At the end of six or seven weeks the fracture generally unites.

When instead of a transverse direction, the fracture has taken a very oblique one, the mode of treatment is very different, and permanent extension becomes necessary: a very convenient mode of applying this was contrived by the late Dr. James Hutchinson. Two splints of wood are made, long enough to extend from the knee

PLATE. IX.



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six or eight inches below the sole of the foot; a mortise hole is cut near the lower end of both these splints, and the upper extremity of each is perforated with four small holes. A piece of wood fitted to the mortise holes of the splints, eight inches long, is to be provided.

In applying this simple apparatus, the patient is to be laid on his back, and extension and counter-extension made as usual; a pillow is placed under the leg upon which is arranged a bandage of strips; two pieces of tape are next to be secured by numerous turns of a roller, on each side of the leg below the knee: these tapes are to be passed through the four holes in the upper end of the splint, and tied, a silk handkerchief is next to be passed round the ankle, crossed on top of the foot, and tied under the sole. The fracture being reduced, the bandage of strips is applied neatly to the leg, and the silk handkerchief next tied over the cross piece connecting the two splints; by which any necessary degree of extension may be permanently applied.

The annexed plate represents the apparatus and its mode of application, very intelligibly. It is particularly convenient in compound fractures, because the external wound can be dressed daily, without disturbing in the slightest degree, the fragments of the bone; but it cannot be used in fractures near the knee or ankle joints, because the bands for extension and counter-extension would irritate the inflamed parts and could not be borne. Excoriation must be guarded against by applying soft compresses wherever the skin is irritated by the extending forces; it is convenient to interpose a small compress of folded linen with this view, between the tapes and skin, or what is equally effectual, to pass the roller once or twice round the limb before they are applied.

In some cases the irritation at the knee is very great, and the leg swells from the pressure of the circular bandage below it: when this happens in oblique fractures of the leg, the long splint of Desault must be substituted, and the counter-extension made against the pelvis. It is to be applied in the same manner as to a fractured thigh, excepting that the leg must be dressed with the bandage of strips; the two long splints are all that will be found necessary.

It is of great consequence in all oblique fractures of the leg to attend particularly from day to day, to the form of the limb, and the position of the foot, which should be supported by a bandage, as before directed, or by a prop of wood attached to the splints or bedstead. If the heel sinks too low, so as to cause the lower fragment to fall downwards, a piece of folded linen or flannel must be placed under it.

The general treatment of the patient is of great importance in these cases, and blood-letting is to be performed as often as the degree of fever and inflammation may indicate. It is by far the most convenient mode of depletion, and the most efficacious.

COMPOUND FRACTURES OF THE LEG, are from the thin covering of the tibia, and its exposure to accidents, more frequent than any other compound fracture. The general directions for their treatment have already been detailed. But it may not be improper to remark in this place, that the permanent extension kept up, either by Desault's or Hutchinson's splints, enable the practitioner to dress the fracture, as often as necessary, without any pain, or inconvenience to the patient, and without retarding the progress of the cure by moving the fragments of bone—circumstances of great importance at all times, but particularly in warm weather when the dressings must be very frequently changed. Should the discharge be very copious from a compound fracture of the leg, the pillow upon which it rests should be covered with thin oiled silk, to prevent its imbibing the offensive matter, and great cleanliness should be observed.

FRACTURES OF THE TIBIA alone, sometimes happen: the fracture is generally transverse and attended with but little derangement of the fragments. The fibula being uninjured, prevents the shortening of the limb, and as no great pain or inconvenience is experienced, the case is sometimes not discovered until a considerable time has elapsed. A careful examination with the fingers will in general, from the thinness of the covering over the tibia, enable the surgeon to detect an inequality at the place of fracture. Crepitation may also in general, be occasioned, by forcibly pressing the fragments in opposite directions.

The treatment of the case is extremely simple; rest on a pillow, is all that is essential, but it is most prudent to apply the dressings recommended for transverse fractures of both bones of the leg, and to keep the patient in bed until the cure is effected, viz. forty or forty-five days.

FRACTURES OF THE FIBULA are less frequent than those of the tibia, notwithstanding its slender size, owing in great measure to the circumstance that it is not concerned in supporting the weight of the body.

The chief causes of fractures of the fibula, are a violent blow on the outside of the leg, or a forcible abduction of the foot. There is reason to believe that in many cases of sprained ankle this fracture exists without being known. No shortening of the limb takes place, and the only displacement observed, is the fragments being pushed inwards towards the tibia.

To ascertain the existence of the accident, the bone should be pressed inwards, and crepitation will generally be perceived, or at least a motion of the bone at the place of fracture.

The mode of treatment, consists, in an attempt to force the fragments outward by abduction of the foot, and by pressure upon the interosseous muscles after which two pasteboard splints are to be applied, as in transverse fractures of both bones of the leg, and the patient must be kept at rest thirty or forty days. The splints are chiefly useful by keeping the ankle joint at rest.

The approximation of the fibula to the tibia, is not so important as that of the radius and ulna, because no rotatory motion exists between the bones of the leg. A slight stiffness of the ankle joint is commonly a consequence of fractures of the fibula, but it soon subsides without any remedy but exercise.

CHAPTER XXXII.

Fractures of the bones of the Foot.

FRACTURES of the OS CALCIS are very rare, but occasionally happen. The accident may be detected by a crack at the moment attended with severe pain at the part, and great difficulty in standing upright, a swelling of the heel and mobility of the fragments attended with crepitation.

To reduce the fracture, the leg must be flexed upon the thigh, and the foot extended on the leg. In which situation the fragments can readily be reduced. Boyer directs in order to retain the fragments, the slipper invented by Petit, for a rupture of the tendo achillis, or if that cannot be procured, the uniting bandage used for transverse wounds, modified as follows. The end of a bandage is placed on the superior surface of the foot, whence the bandage is reverted on the sole, and the end is made fast by circular casts around the foot; this bandage is then drawn along the posterior side of the leg to the ham, the foot being previously extended, on which part it is fixed by other circular casts, it is thence brought downward forcibly, and the application terminated by rolling along the leg what remains. To this bandage may be added a long compress, the middle part of which should be applied above the posterior portion of the os calcis, and the extremities crossed on the superior surface of the foot, and turned under the sole; this compress may be fixed by a bandage rolled on the foot in the shape of the figure 8. The union of the fracture is effected in thirty or forty days, at the end of which time the patient may be allowed to bend his foot. He must, however, for some days, avoid any forced flexion of the foot, as also any excessive extension by rising on his toes."

"The other bones of the tarsus, as the astragalus, cuboides, scaphoides, and three ossa cuneiformia, are susceptible only of comminutive fracture. The same may be said of the bones of the metatarsus and phalanges of the toes." The treatment of these fractures can be very sufficiently understood from what has been said of fractures of the bones of the hand, to which they are analogous.

CHAPTER XXXIII.

Of Wounds of Bones.

In the following observations on the denudation and wounds of bones, I shall avail myself chiefly of the labours of Boyer and Hunter.

The bones may be stripped, not only of the integuments, muscles, &c. by which they are naturally covered, but also of the periosteum, which is their intimate and appropriate covering.

Cutting or contunding instruments may produce this denudation of the bone, without injuring its substance, or they may cut or contuse its external fibres. These two cases must be carefully distinguished, as the contusion of the bone is attended with consequences much more serious than those of a simple denudation.

If the bone has been merely stripped of its periosteum and integuments, and those parts are immediately replaced, so as to exclude the contact of the air and bandages, the reunion of the periosteum is found to take place in a very short time. But if the external lamina of the bone has been contused, or if its surface has been left a long time exposed to the action of the air, or to the friction of bandages, exfoliation becomes a natural consequence. All the external lamina must separate; and before this separation is effected, the cicatrization of the external wound would be rather injurious. Should the wound in the integuments be prematurely closed, purulent matter will continue to form underneath, the contused lamina will exfoliate, an abscess will point externally and burst spontaneously, and the matter that escapes from it will contain small splinters of bone.

Old age is unfavourable to the healing of wounds and contusion of the bones; because as the cure can be effected only by means of the vascular texture of the bone and periosteum, the turgescence and expansion of this must be slow and difficult in proportion to the person's age. The treatment adapted to the different cases is as follows.

If the bone be simply laid bare, the integuments, if not completely separated, should be instantly replaced. This precept holds good in all cases, whatever may be the patient's age, if the bone has not been already exposed to the contact of the air. At the same time it must be allowed, that it is very difficult to know by mere inspection, whether the bone be contused or not; but should that be the case, and even should suppuration and exfoliation be inevitable, no bad consequences can result from the attempt to produce an immediate cicatrization; whereas, in the contrary event, the duration of the treatment will be much abridged. If it be possible to unite the wound by the first intention, its lips are to be kept separate by lint interposed, and the whole is to be lightly covered. In a short time granulations appear, and the external lamina of the bone exfoliates. Sometimes, however, and particularly in young person, the bone becomes soft and red, and granulations arise from it, which bleed from the slightest cause. It has been said that the bone exfoliates insensibly in this case; but this observation is not found to be true: the laminæ of the bone are not broken down, dissolved, and carried off by suppuration. The change consists of a softening of the bone, and conversion of it into a fleshy substance, which unites with the soft parts.

In this last mentioned case, the cure is much more prompt than when a real exfoliation takes place. The process of exfoliation resembles that of the separation of gangrenous eschars: the mode in which the separation is effected, is equally unknown in both cases.* In exfoliation, it is merely known that the subjacent vessels grow turgid, expand, and pullulate, and that a line of separation is observed between the contused laminæ and the sound part of the bone. The former are undetermined, as it were, and their connexion shaken by the purulent matter formed under them, and at length are entirely detached, and may be easily removed by the fingers or a forceps. When the bottom of the wound is entirely freed, the granulations that arise from it, unite with the soft parts, and in a short time the wound is cicatrized.

Various processes have been employed for expediting the exfoliation. Thus the ancients covered the bone with pledgits of lint impregnated with spirits, or with a tincture of myrrh and aloes; but it is found, that these applications retard the exfoliation by opposing the expansion of the vessels; for which reason they have been laid aside, and oily relaxing applications have been substituted for them.

It has been proposed to perforate in different parts the laminæ which are to exfoliate, on the supposition that this practice facilitates the growth of the granulations. The perforations certainly have this effect, but the granulations by shooting up through them, retain the laminæ rather than aid their exfoliation: each vessel spreading as it rises, and assuming in some respect the shape of a broad-headed nail. It will then be more prudent to limit the treatment to the use of unctuous or emollient applications. By means of these remedies, the texture of the part will be sufficiently relaxed, and the developement of the vessels facilitated. But if the portion of the bone to be exfoliated be very considerable and deep seated, these applications are nearly useless, at least their effect must be very trifling; then we must content ourselves with covering the part with lint, and trusting to time and nature for effecting the separation.

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* Mr. Hunter has fully explained this formerly unintelligible process. See page 207 of the present volume.

Though the exfoliation be complete, as may be known by the motion of the piece, it may still happen that the circumference of the detached portion may be encroached on by the growth of the soft parts, and thus prevented from separating. In this case it will be necessary to disengage it by making an incision in some point of the circumference of the wound, after which it may be drawn out by the fingers or a forceps. In general there is but very little difficulty in removing it.

The action of cutting instruments is not always limited to the mere denudation of the bone; they sometimes completely divide it: this, however, is but a rare occurrence. It sometimes happens that a part of the bone is cut off, of which there are numerous instances in wounds of the head, where a part of the parietal bone, with its pericranium, a portion of the occipito-frontalis muscle and hairy scalp, have been entirely separated by a blow of a sword.

When a wound of the soft parts is accompanied by a similar affection of the subjacent bone, an immediate reunion of the soft parts must not be attempted. Lint is to be gently introduced into the fissure, and the wound healed from the bottom; for a solid cicatrix of the soft parts cannot be expected until the wound in the bone is first cicatrized.

If the bone in one of our limbs be cut quite through, as in the cases mentioned by La Peyronie, Warner, and others; and if a piece of flesh remain undivided, which contains the principal vessels of the limb, it will be prudent to reunite the parts, and place the limb in the apparatus used in cases of fracture of the part.

The time necessary for the reunion of the parts in cases of this nature, is full as long as that in those of fracture, and the consolidation is effected in the same manner as in the former case.

In the preceding remarks, Mr. Boyer has not attempted to explain the manner, in which bone that has been contused and suffers death, in consequence of a blow, separates from the living bone with which it is in contact. I shall therefore state in this place the opinion on the subject, taught by Mr. Hunter, and now generally adopted.

EXFOLIATION is the separation of dead from living bone, as SLOUGHING is the separation of dead from living flesh, and the process in both cases, is effected in the same manner, by the action of the absorbent vessels. There is nothing like a melting down of the bone; no solution takes place; the bone separated is solid and in texture unchanged, and the term exfoliation was derived from the scales or *leaves* of bone thus detached. In bones which are most solid, and have fewest cells, the separation takes place most rapidly. I have known a portion of the radius exfoliate in a few days, and I have known the os calcis, several years in casting off a portion of dead bone. The entire death of a portion of bone, is necessary to its exfoliation, and hence, in some cases, the hot iron may be used with advantage in expediting the process, by destroying the life of diseased bone. According to Mr. Hunter, caustics and hot irons may expedite exfoliation in two ways, first by killing the bone, and secondly by inflaming the adjacent bone, and thus increasing its vascularity and its actions. Dead bone like all other extraneous matter, stimulates the adjacent parts, in consequence of which they become more vascular. The bone is composed of animal gluten, and earth; the earthy portion *of the living bone*, is removed by the action of the absorbents; just as in health these vessels perform the process of interstitial absorption, removing from time to time the solid parts of the body. The consequence of this absorption of the earthy particles from the bone, must necessarily be, that the bone is converted into a *soft matter*, which is interposed between the living *solid* bone, and the dead *solid* bone. The soft substance thus interposed, is last of all absorbed, and the dead bone left without any connection with the living. We are, therefore, to consider the living bone as effecting the whole business of exfoliation, through the agency of its absorbing vessels, and these vessels act on the living matter, and perhaps also, on the dead part immediately in contact with it.

The process of exfoliation begins at the surface of the bone, and proceeds irregularly, not progressing uniformly, in the same direction, or with the same celerity in every part; circumstances not easy of explanation. During the continuance of this absorption of the bone, granulations of a fungous nature, shoot out from the surrounding parts, and by pressing on the loosened bone, push it outwards towards the surface of the body, in the same manner as any other loose extraneous matter would be cast off, by the ulcerative process.

The edge of dead bone, presents an unequal ragged surface, "a groove or worm eaten canal" being interposed between it and the sound bone.

The highly interesting physiology of the absorbent vessels, and their agency in this process, have been most ably developed by the late John Hunter, the first writer who threw any light on the subject.

CHAPTER XXXIV.

Of Dislocations.

A Dislocation or Luxation signifies the escape of the articulating surface of a bone, from its natural situation; as of the head of the thigh bone from the acetabulum.

A knowledge of anatomy is essential to the comprehension of all surgical cases, but the reduction of dislocated bones in some instances occasions great difficulty, and calls for a complete and accurate knowledge of the parts concerned in forming the joints, and of the effects of the muscles acting upon the displaced bone; a kind of knowledge not to be obtained simply from osteology or a study of the skeleton, but demanding a frequent inspection of the fresh joints, covered with cartilage and surrounded with ligaments, &c.

Some bones in consequence of the structure of their joints and their exposure to accidental violence, are very frequently luxated, as the os humeri at the shoulder; others from opposite circumstances, are very rarely dislocated, as the vertebræ. In general the liability to luxation is proportionate to the degree of motion which the joint possesses, and hence the ball and socket joint allowing motion in all directions, is the seat of dislocation most frequently. In the joints possessing a hinge-like, or ginglimus motion, the accident is proportionally rare, in consequence of the greater extent of the opposing surfaces forming the joint, and of the strength of the ligaments which surround them, added to which, they are less frequently exposed to force in a direction proper for separating their articulating extremities.

Luxations are said to be COMPLETE, when the bones of the joint are entirely separated; INCOMPLETE, when some portion of the articulating bones remain in contact. The only instances of incomplete luxation occur in the articulations by ginglimus; as the knee, elbow, or foot; and here a complete luxation is very rare, from circumstances obvious to every one who is conversant with the structure of these joints.

The longer a bone is suffered to remain in the new situation into which it has been forced, the more difficult will it be found to reduce it to its natural place. The soft parts having accommodated themselves to the new position; the muscles being shortened; after a longer time, adhesions forming; and lastly, actual concretion of the dislocated bones in a situation remote from the joint, or the formation of a new moveable joint; these are circumstances which increase the difficulty of replacing the luxated bone, in proportion to the length of time which has elapsed after the accident.

LUXATIONS like fractures, have been divided into SIMPLE and COMPOUND. The simple being accompanied with no external wound, the compound having a wound communicating with the cavity of the joint, formed either by the protrusion of the bone through the integuments, or by the cause of the luxation dividing them at the time of the accident. Luxations may be complicated with various other mischief, by the injury of blood-vessels, nerves, &c.

The immediate causes of the luxation of a bone are violence applied to the joint, and the action of muscles. In an enarthrosis joint (ball and socket) if the direction be not oblique, it is impossible for the bone to be dislocated. Boyer has illustrated this by the example of the os humeri. If this bone "hang exactly along side of the body, or perpendicularly with respect to the glenoid cavity of the scapula, no force is capable of luxating it. If a person fall on the elbow while the fore-arm is in this position, the head of the humerus will be forced against the cavity formed to receive it; but if the arm be removed from the body, the axis of the os humeri will fall obliquely on the surface of the glenoid cavity, which will favour its passing out of the socket; and this disposition to luxate, will be encreased in proportion as the angle formed by the axis of the bone with the surface of the cavity deviates from a right angle.

The action of muscles probably very often assists in dislocating bones; sometimes no other cause exists. I have known the patella dislocated laterally, by a lady in dancing, and in convulsions different bones are occasionally luxated.

Some joints we have already noticed, are more liable to dislocations than others. This predisposition may depend on great latitude of motion; on the small extent of articulating surfaces in contact; the laxity and small number of the ligaments uniting them; paralysis of the muscles surrounding a joint; and whatever has a tendency to weaken the different connections between the bones.

In some instances the soft parts connecting the bones, are so relaxed that a very slight force suffices to dislocate them. I have known a woman whose shoulder was liable to luxation from exertions of the most trifling force, and Boyer relates the case of a patient who could not yawn even moderately without dislocating her jaw. These luxations are, from the same relaxation which gives rise to them, very readily reduced, unless this process be too long delayed.

Boyer declares, that " whatever may be the manner in which the causes act, luxations are always accompanied with more or less laceration of the ligaments surrounding the joint; and in the round articulations, as those of the shoulder and hip, the fibrous capsules are always torn." He ought to have excepted cases similar to those noticed in the last paragraph.

The symptoms which distinguish luxations, are pain and inability to move the member, a change in the appearance of the joint, an elongation or shortening of the limb, an impossibility of performing certain motions. By careful examination the displaced bones may often be felt in their new situations; producing eminences where there are naturally depressions, and vice versa; but a more explicit account of these symptoms will be delivered when the different luxations are particularly described.

THE TREATMENT OF DISLOCATIONS consists in replacing the bones, and retaining them in their natural situation. The reduction is to be effected as in fractures, by extension and counter-extension. There is in general no difficulty in keeping the bones in their natural position when they have once regained it.

The principal obstacle to the replacement of a bone, recently dislocated, is the action of muscles drawing its articulating surface into a situation remote from that, which it ought to occupy. It frequently happens, that after the head of a bone has been forced out of its natural place, it passes over certain bony prominences, and then takes a situation in a depression of bone, from which it must be forcibly raised before its reduction can be effected. Instances of these bony resistances to the reduction are found in luxations of the thigh bone; the head of the femur passing over the high margin of the acetabulum lodges in the foramen thyroideum, or on the dorsum ilii, and before it can be replaced in its natural socket, it must reascend the prominences over which it has passed.

For the purpose of applying extension and counter-extension for the reduction of luxated bones, a variety of machines have been contrived, which it is unnecessary to detail in this place. The only means at present in use, are the hands of assistants, and compound pullies. Whenever we can avail ourselves of the aid of a sufficient number of assistants, this mode of applying force is to be preferred, because its direction and degree may be altered instantly by a word.

The parts to which force should be applied in reducing luxations, can be better explained by describing the different dislocations, than by any general rules. In most cases the force should be made to act as directly as possible upon the affected joint. Boyer and the generality of French surgeons direct, on the contrary, that "the extending force should be applied not on the luxated bone, but on that with which it is articulated, and as far as possible from it." A rule which can be applied with advantage to very few cases.*

The degree of force to be employed can only be estimated by the difficulty of the reduction, *it should always be sufficient* to accomplish that end. Although it is to be constantly recollected, that force alone is never to be relied on, but skill in the direction of it is ever to be exerted. A force sufficient to tear off a limb has been applied without reducing a dislocation. In estimating the force to be employed, the obstacles to be encountered should be carefully kept in view, and when these are clearly understood, the direction of the extending powers and the degree of their violence will be the more easily judged of. It should in every instance be gradually applied: Mr. Pott remarks, that "whatever kind or degree of force may be found necessary for the reduction of a luxated joint, that such force be employed gradually;

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* Mr. Pott advocates the principle I have recommended, and most of the British surgeons, as usual, oppose the French.

that the lesser degree be first tried, and that it be increased gradatim." This important rule if carefully observed will prevent all serious mischief from the use of the force necessary even in the most chronic luxations.

Napkins and strong bands or girths, fastened upon the limb by means of cotton rollers, enable the requisite number of assistants to act at the same time. To prevent excoriation of the skin where great force is necessary, Dr. Physick has applied a piece of buckskin with advantage, between the cuticle and the extending bands.

Counter-extension applied to the bone with which the luxated one was articulated, should always be made at least equal to the extension. If for example, three assistants are employed in extending a luxated arm, a force equal to three should be employed in fixing the scapula. Counter-extension may often be made by securing a band to a staple in a wall, or some secure position.

In attempting the reduction of difficult luxations the position of the patient should be changed. After an erect posture has been tried, a recumbent one should be substituted; if this fail, the patient may sometimes with advantage be seated in a chair.

"Great advantage is derived in the reduction of dislocations from attending to the patient's mind; the muscles opposing the efforts of the surgeon, by acting in obedience to the will, may have that action suspended by directing the mind to other muscles. Several years ago, a surgeon in Blackfriar's Road asked me to see a patient of his with a dislocated shoulder, which had resisted the various attempts he had made at reduction. I found the patient in bed with his right arm dislocated; I sat down on the bed by his side, placed my heel in the axilla, and drew his arm at the wrist; the dislocated bone remained unmoved. I said, "Rise from your bed sir;" he made an effort to do so, whilst I continued my extension, and the bone snapped into its socket; for the same reason, a slight effort, when the muscles are unprepared, will succeed in reduction of dislocation after violent measures have failed."* (ASTLEY COOPER.)

In recent luxations it has been already noticed that the principal difficulty experienced, is in overcoming the contraction of the muscles. The fatigue of the muscles occasioned by long continued efforts at reduction, often produces a relaxation which permits the bone to return to its natural place. Dr. Physick many years ago employed copious blood-letting with this view. He bled the patient until fainting was produced, and during his continuance in a state of syncope all muscular action being suspended, the reduction was readily accomplished. In a great number of instances which have since occurred, the practice has been found completely successful. There are several writers who recommend bleeding to diminish the action of the muscles in obstinate luxations, but none (so far as I know) who propose bleeding ad deliquium animi, except Dr. A. Monro, sen. who suggested in his lectures on surgery copious blood-letting from one or both arms in an erect posture, as a probable means of facilitating the reduction of dislocations; but Dr. Physick I believe was the first who had the boldness to carry the practice to the extent necessary for complete success. The first case in which it succeeded, was a luxated humerus, which had baffled every mode of applying force, and a very great degree of force had been used. During the fainty state, the hands of the operator were the only means employed, and in a single moment, without the slightest difficulty he replaced the head of the bone in its socket.

In cases where blood-letting to the necessary extent is inadmissible, other means of suspending the action of the muscles are to be used. Perhaps nauseating doses of emetics, or the tobacco glyster, might be employed with advantage.* Intoxication has been recommended. I once saw it succeed completely in a case of dislocated jaw, which no previous efforts were effectual in reducing. It was resorted to by Dr. Physick, on account of the extreme debility of his patient who was dropsical, and whom blood-letting would probably have destroyed.

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* This fact, and the practice deduced from it, have been long since pointed out by Dr. Physick, in his Surgical Lectures, and exemplified at the Pennsylvania hospital.

The effects of blood-letting ad deliquium animi in facilitating the reduction of dislocated bones, has been very strikingly exemplified in several chronic luxations, which have occurred in different parts of the United States. Dr. Physick reduced a luxated humerus which had been out of place forty-five days, with very great facility; and in a case which occurred at Baltimore, the arm had been dislocated five or six months and was replaced by Dr. M'Kenzie by the aid of the same remedy.†

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* From the surgical essays of Mr. Astley Cooper and Mr. Travers, published in this present year, 1818, it appears that blood-letting, the warm bath, and nauseating doses of emetics, have been freely employed to diminish muscular action, by various British surgeons, and with great success.

† The following extract of a letter to Dr. Physick, contains the history of this truly remarkable case, of the success of which I believe no parallel is to be found in the records of surgery.

"B. J. a seaman aged about thirty-five years, was admitted into the Baltimore hospital in the month of September 1805, with a luxation of the os humeri. The account he gave of his case was, that while on a voyage to Liverpool, and two weeks after leaving this port, he fell from a considerable height and dislocated his shoulder, and that an attempt was made by the captain of the ship to reduce it, but without success; that upon his arrival at Liverpool repeated trials were made to effect reduction of the bone, but to no purpose, and he had now remained in this situation *between five and six months.*

"Upon examining the shoulder, I found the head of the humerus under the pectoral muscles, where it had imbedded itself, and appeared to have formed considerable connexions with the surrounding parts.

"In this state of things I deferred any attempt to reduce the bone till the following day, when in consultation with my friend Dr. Smyth, it was determined at once, to have recourse to bleeding ad deliquium, as the only plan in our view likely to succeed; and having secured our patient in the usual manner, a vein was opened, and nearly *five pounds of blood* were drawn before fainting could be

An erect posture, as being most favourable to the production of syncope, should be preferred.

It is proper to remark, however, that after a bone has continued several months dislocated, it forms adhesions in its new situation; probably the rent in the capsular ligament contracts, or even heals up. Inflammation produces great changes in the structure of the parts and increases greatly the difficulty of reduction. Rotating the bone and moving the joint in all possible directions, are necessary to destroy these adhesions, and long continued efforts sometimes succeed when the surgeon had nearly despaired of accomplishing his object. Perseverance, therefore, is to be strongly recommended in all recent luxations, and even in those which have existed several months.

To preserve the bone in its proper place nothing but rest is necessary. Very little bandaging is required for this purpose, but it should be remembered that a joint which has been dislocated has suffered necessarily a great deal of contusion and that it will probably inflame very considerably. The usual means of combatting this inflammation when it occurs, among which rest is indispensable, are to be employed. It is proper in most cases, to bathe a joint which has been dislocated with a solution of sugar of lead or with some cooling lotion.

Luxated bones which are not reduced, sometimes re-

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produced; this, however, was at length completely effected, and with (comparatively speaking) very little effort the bone was reduced.

"It is worthy of remark in this case, that neither swelling nor inflammation succeeded the reduction of the bone, and the poor man was dismissed well in the course of two weeks.

"I am, &c.

"COLIN M'KENZIE."

Desault's most chronic case was of three months duration, and I believe Dr. M'Kenzie has accomplished what no other surgeon of this or former ages can boast of having performed.

main in the situation into which they had been at first forced; more commonly, however, they change their situation, being drawn by the action of muscles further and further from the cavity of the joint. In its new situation it excites inflammation and a thickening of the surrounding soft parts; if in contact with bone, this bone becomes inflamed, and after a time a depression is formed in it which receives the head of the dislocated bone, and a kind of imperfect joint is formed; the muscular flesh and cellular texture are changed into a ligamentous matter which assist in supporting and strengthening the new articulation. In various anatomical collections are preserved curious specimens of these newly formed joints, affording wonderful proofs of the resources of the animal œconomy. The socket of the joint from which the bone had been displaced, sometimes fills up with a thickening of the ligaments, and the usual matter of adhesions, though in other cases it remains very little changed in structure.

The muscles of a limb permanently dislocated shrink and lose their strength, and although in some cases a power of motion is regained after a time, yet it is always very limited and imperfect.

Of COMPOUND DISLOCATIONS. These are among the most dangerous accidents to which the bones are liable; all the dangers of wounded joints, and of compound fractures, are to be dreaded from them. The question of amputating a limb in which a compound dislocation has happened, is attended with all the difficulties, already noticed when speaking of wounded joints. The various circumstances of the patient in each particular case must be taken into view, and no general rules for deciding it, can be laid down.

The principal object in the treatment of compound dislocations is, after reducing the bone, to procure as speedily as possible the union of the external wound, thereby precluding the dangers of an exposed joint. For this purpose its edges should be brought as nearly as possible into contact, and retained so by adhesive plaister, and the joint kept perfectly at rest by bandages, splints, and a proper posture.

CHAPTER XXXVI.

Of Particular Dislocations.

DISLOCATION OF THE LOWER JAW.

This accident happens generally in adults and never in young infants, because in the latter the angle of the jaw is obtuse, in consequence of which the condyles by which it is articulated with the temporal bones have the same direction as the basis of the jaw, and from this structure the mouth cannot be opened wide enough in infancy to separate the articulating surfaces.

Sometimes one and sometimes both condyles are dislocated. The only direction in which the displacement can happen is forwards. In most cases the accident is produced by yawning, or opening the mouth excessively wide. A woman in scolding her husband, in a very vociferous tone, found herself unable to close her mouth, and applied to Dr. Physick who found both condyles of the lower jaw dislocated. A blow upon the chin whilst the mouth is opened may also occasion the same effect.

The symptoms which denote this luxation, are an inability to close the mouth, which is kept considerably open; immediately before the ears where the condyles naturally occasion a fulness, an empty hollow space is perceived; the coronoid process is felt projecting more anteriorly than natural; the cheeks and temples are flattened; the saliva flows from the mouth; the patient speaks and swallows with great difficulty; the chin projects forward. When the jaw continues dislocated several days these symptoms are not so strongly marked, but they still exist, to a greater or lesser degree.

To effect the reduction the patient is to be seated on a low chair, his head supported against the breast of an assistant; the surgeon defending his thumbs with a piece of leather, or linen, places them as far back upon the molar teeth of the lower jaw as possible, the fingers are then placed under the chin, and whilst he presses down the back teeth with his thumbs, he at the same time elevates the chin; by this manœuvre he uses the base of the jaw as a lever of which his thumbs represent the fulcrum, and disengages the condyles from the zygomatic fossæ in which they had been lodged; when the condyles are found moving, the chin is to be pushed backwards, and the reduction is effected. At this moment it behoves the operator to be careful in removing his thumbs from between the teeth, for the condyles regain their situation very suddenly, and the jaws are spasmodically closed, with great force. To prevent their being bruised he slips them very quickly outwards between the cheeks and teeth, where they are safe.

After the reduction the jaws should be kept at rest a few days by a bandage passed round the head and chin, the patient being nourished with spoon victuals.

It has been proposed to reduce this luxation by a sudden blow on the chin, knocking it upwards and backwards. This plan has sometimes succeeded but it is always attended with great danger of breaking off the condyles of the jaw.

When only one condyle is dislocated the reduction is effected in the same manner as when both are displaced, except that only one hand is necessary.

Le Cat succeeded in reducing an obstinate dislocation of the jaw by introducing a stick between the back teeth and using it as a lever continually prizing the teeth of the upper and lower jaw apart, until the muscles which were spasmodically contracted, became fatigued and then the reduction was easily effected.

Dr. Physick was consulted a short time ago by a young woman who had been salivated for the cure of a dropsy, the inflammation and swelling of the jaws in consequence of the use of mercury were very great, and during the continuance of these symptoms she dislocated (without knowing how or when) both condyles of the lower jaw. When the effects of the mercury had somewhat subsided, she perceived her inability to close her mouth, and her physician soon discovered that the jaw was luxated. She came to Philadelphia, and Dr. Physick attempted its reduction in the usual manner, but not succeeding, the plan proposed by Le Cat was tried without effect, her molar teeth being almost all carious prevented any violent efforts upon them, with the wooden lever. Her extreme debility and dropsical habit, precluded blood-letting and I suggested to Dr. Physick the propriety of trying the nauseating effects of *tobacco*. She refused this however, and the Dr. next proposed to give her as much ardent spirit, as should occasion intoxication. She consented and became perfectly inebriated, and whilst inebriated was prevailed on to smoke a segar, great nausea ensued, during which time the measures which had been before unavailing, very promptly succeeded in effecting the reduction.

CHAPTER XXXVII.

Dislocations of the Vertebræ.

THE excellent work of Boyer will furnish the following Chapter.

"The large surfaces by which these bones correspond, the number and thickness of their ligaments, the strength of the muscles lying on the column formed by them, the small motion of which each vertebra is capable, and lastly, the vertical direction of their articulating apophyses, render a luxation of them in the dorsal and lumbar part of the column, entirely impossible. A violence, though ever so considerable, cannot displace them without first fracturing them. The same is not the case with the cervical vertebræ; the extent of their articulating surfaces is less, the ligamento-cartilaginous substance which unites their bodies has more pliability, the motion of their articulations is greater, and their articulating surfaces have an oblique direction, which allows them to have an obscure rotatory motion; consequently luxations of them are sometimes met with. I have seen a case in which the neck was luxated by a violent rotatory motion of the cervical vertebræ, and the luxation resisted all means that were employed to reduce it. The cause of impediment was felt towards the middle of the column formed by the cervical vertebræ; from which circumstance we may conclude that the dislocation did not consist of a separation of the first vertebra from the second, which is admitted to be possible by all authors, but that it took place lower down in the cervical part of the column.

It appears from well attested facts, that luxations may take place in the vertebral column; such as those of the head from the first vertebra, and of the first vertebra from the second. These, and especially the latter, are the most frequent; but others, though much rarer and more difficult, may, however, take place.

The articulation of the occipital bone with the first vertebra of the neck is strengthened by means of many ligaments, and admits of only very limited motions. It is well known, that the motions of inclination of the head to the right and left, and of flexion and extension, take place along the whole length of the cervical vertebræ. We have no instance of luxation of the head from the first vertebræ by an external cause; such a dislocation, if possible, would instantly destroy the individual to whom it happened, by the compression and disorganization of the spinal marrow. But nature which cannot bear so sudden a change, is habituated to it when it takes place gradually and insensibly; and the spinal marrow, which a sudden though inconsiderable derangement of the spine would totally disorganize, is not sensibly injured when it takes place by degrees; cases of rachitis furnish us many proofs of this. It is only in this way that we can explain how the individual from whom the preparation in the Museum of Natural History was taken, could exist until such very great deformity took place in his spine.

It is principally in the triple articulation of these two vertebræ, that the motion of rotation of the head to the right or left takes place; for the union of the first vetebra to the occipital bone is so close, that the motion of both is the same. This rotation of the first vertebra on the second, which the laxity and weakness of the ligaments that go from one to the other, and the direction of their articulating apophyses, render easy, would be frequently carried beyond its natural bounds; and luxation would take place every time we turn our head with force, if the motion were not confined by two very thick ligaments, which go from the sides and summit of the toothlike process of the second vertebra to the edges of the great occipital hole. When this motion is forced beyond its proper limits, the ligaments are torn, and the lateral parts of the body of the first vertebra glide along on the articulating horizontal processes of the second. If the head is turned from the left to the right, the left side of the body of the vertebra is carried before its corresponding articulating surface, whilst the right side falls behind its corresponding surface. In this luxation, sometimes the toothlike process, the ligaments of which are broken, leaves the ring formed for it by the transverse ligament and the anterior arch of the first vertebra, and presses on the spinal marrow, the substance of which it destroys; at other times it remains on its ring, but the diameter of the vertebral canal is always diminished at this place, and the spinal marrow experiences a compression, and at the same time a contortion, by which it is lacerated. It is easily conceived that the patient cannot survive a derangement of this nature; every lesion of the spinal marrow at this height is quickly fatal. Louis, in making researches on the manner of dying of hanged persons, found that those despatched by the executioner of Lyons, perished by the luxation of the first vertebra from the second; whilst those hanged at Paris were suffocated by strangulation. He discovered the cause of this difference in a rotatory motion given to the body of the culprit by the executioner of Lyons, at the moment that the ladder was taken from under his feet. We ought to attend to this observation, when we examine in a judicial capacity the body of a person found hanged. We should carefully examine the second vertebra, and see if it be luxated. If so the individual has not been guilty of suicide, for the luxation must have resulted from a violent motion communicated to the body by the assassin.

The following case by J. L. Petit, furnishes an instance of luxation produced by the person himself; the circumstances of it are so extraordinary, that we shall relate them at full length.

"The only son of a tradesman, aged between six and seven years, went into a neighbouring shop, the proprietor of which was a friend of his father's. This person playing with the child, put one hand under his chin and the other on the back of his head, and then raised him up in the air, telling him he was going to shew him his grandfather, a common expression among the vulgar. Scarcely was the child raised from the ground, when he began to struggle, and by his efforts dislocated his neck, and died on the spot. The father, on hearing of the death of his child, ran in a fit of passion after his neighbour, who fled before him, but not being able to catch him, he threw at him a saddler's hammer which he had in his hand, and buried the cutting part of it in the depression of his neck. The weapon cut all the muscles, penetrated into the space between the first and second cervical vertebra, divided the spinal marrow and occasioned almost instantaneous death. Thus both perished nearly in a similar manner." J. L. Petit, who quotes no authority to support this fact, avails himself of the opportunity of censuring this dangerous kind of play, and observes with justice, that the motion which the child gave himself was the cause of his death.

The relaxation of the ligaments of the toothlike process may favour this luxation. Such probably was the case of a young man, who found a difficulty to bring his head back to its natural posture, each time that he turned it to the right or left. There are many cases of luxation of the neck, in which death does not succeed the accident; but in these the luxation takes place in the third, fourth, fifth, or sixth vertebræ, and only one articulating process is luxated: in these cases, the diameter of the vertebral canal is not so much diminished as to compress the spinal marrow, and destroy life; but a wry-neck remains, which becomes incurable, unless the real cause be found out.

A child, playing on his mother's bed, suddenly felt pain in his neck, accompanied with a distortion which he could not remove. Desault, to whom the child was brought, discovered a luxation of the vertebræ of the neck; but before trying to reduce it, he informed the mother that the child might die in the attempt. This information terrified the mother so much, that she took the child away without having any thing done to relieve it.

A lawyer writing at his desk, heard the door behind him open; he quickly turned round his head to see who was coming in, but could not bring it back again to its natural direction. Many surgeons of Paris have seen this patient: his head was turned to the right, and slightly inclined to the shoulder of the same side. This inclination was much less than it would have been in a spasmodic contraction of the sterno-cleido-mastoideus muscle.

Thus when in consequence of a sudden and violent effort, the head is found turned to one side, either right or left, with inability to bring it back, the ear a little inclined to one side, and the sterno-cleido-mastoideus in a state of relaxation, there can be no doubt but that a luxation of one of the cervical vertebræ has taken place.

If the luxation produce no symptom which indicates a compression of the spinal marrow, it is prudent to abstain from all attempts to reduce it. However, if the patient absolutely insist on our interfering, we are to proceed in this way: we begin by inclining the head to the side towards which it is directed, in order to disengage the articulating process of the upper vertebra: this part of the operation is extremely dangerous, as it may kill the patient by causing a compression of the spinal marrow. When the process is disengaged, the head and neck are brought to their right direction, by making them perform a rotatory motion the contrary of that which had taken place in the luxation. A relapse is prevented by keeping the head free from motion. This is done by means of bandages which are attached to the head and shoulders." (BOYER—Vol. 2.)

CHAPTER XXXVIII.

Dislocations of the Bones of the Pelvis and Thorax.

THE nature of the articulation connecting the sacrum and ossa innominata, and their great strength at the places of their juncture, prevent them from dislocation except by great violence applied immediately at the spot where the synchondrosis exists. The accident in one instance occurred by a heavy body falling on the back of a labourer, who died twenty days after, and upon dissection a luxation of the sacrum was discovered. The right os ilium passed nearly three inches behind the sacrum and the luxated bones moved freely on each other. Great inflammation existed in the parts contained in the pelvis, and pus was found in the abdomen. This case being very analogous in its symptoms and effects to a fracture of the ossa innominata, calls for the same treatment; rest and the antiphlogistic measures, to guard against inflammation. Boyer who relates this case, states further, that in pregnant women the symphysis pubis becomes in some cases so much relaxed that the ossa innominata may be separated, and supposes that something similar may take place to a smaller extent at the sacro-iliac symphysis. These cases call for no surgical treatment.

Dislocations of the os coccygis, may be occasioned in early life by the same accidents which at a more advanced age, would occasion a fracture. The circumstances of the cases being similar, no difference of treatment is required. It is evident that luxations of the bones forming the pelvis have nothing in common with other dislocations; they are in fact fractures of the cartilage connecting these bones; are produced by the same causes, and are to be treated by the same remedies as fractures of the bones. They are extremely rare, as the bones generally yield and are broken by a force capable of producing the dislocation.

The RIBS likewise, are not capable of dislocation, because no force can be applied to their articulation with the vertebræ which will not occasion a fracture.

The starting of the cartilages of the ribs in front is an accident which is not unfrequent; it occurs in certain motions of the arm. Mr. Charles Bell observes, "a young man playing the dumb bells and throwing his arms behind him, feels something give way on the chest; and one of the cartilages of the ribs has started and stands prominent. To reduce it, we make the patient draw a full inspiration and with the fingers knead the projecting cartilage into its place. We apply a compress and bandage, but the luxation is with difficulty retained."

CHAPTER XXXIX.

Dislocation of the Clavicle.

THIS is a rare accident compared with the fracture of the bone. It occurs at the sternal and also at the humeral extremity.

At the STERNAL EXTREMITY the sternum and the cartilage of the first rib prevent the dislocation downwards, but in every other direction it is occasionally dislocated, viz. forwards, backwards, and upwards. In general, the displacement is forwards. It is effected by violent motions of the clavicle backwards. In consequence of this motion the sternal extremity is carried forwards, the ligaments are broken, and the end of the bone is found before the upper end of the sternum, forming a hard projecting tumour, which moves whenever the arm and shoulder are moved.

The treatment of all dislocations of the sternal extremity, consists in the same dressings as those used for fractured clavicle; they reduce the luxation and maintain the proper situation of the bone. The dressings should be continued a greater length of time than in a case of fracture; and in general, some deformity exists, the clavicle being more salient than natural at the place of dislocation.

The HUMERAL EXTREMITY of the clavicle is not so often dislocated as the sternal. It is generally dislocated upward, but it may take place downward, being lodged under the accromion. The dislocation upwards is the only one demanding attention, because the only one in which any difficulty is experienced in maintaining the reduction.

The accident is generally occasioned by falling on the shoulder, and is ascertained by examination with the fingers; the extremity of the clavicle being found under the skin covering the accromion, causing a considerable projection there. The patient inclines his head to the affected side, and moves as little as possible the arm and shoulder, because he cannot move these parts without calling into action the deltoid or some other muscle, which would consequently extend the motion to the diseased part, and cause pain.

The treatment of the accident is to be the same as that recommended for fractures of the clavicle, viz. the apparatus of Desault, which effects and maintains, better than any other, the reduction. That part of the bandage which ascends from the elbow to the shoulder, should in the present case be made as tight as can be borne, in order to press down the clavicle, and keep it in its proper place.

The inconveniences resulting from this accident when improperly treated are very considerable; the motions of the arm being for a long time greatly impeded; they are, however, after a lapse of years gradually recovered.

CHAPTER XL.

Dislocations of the Os Humeri.

These are by far the most common dislocations, and have been supposed to equal in frequency, all others which occur.* The structure of the shoulder joint, in which a spherical surface is articulated with a very superficial cavity, and in contact with it in a very few points, together with the weakness of the ligaments of the joint, and its exposure to violence in performing a great variety of motions, are circumstances which sufficiently explain the frequency of the accident; and it would be still more frequent, were it not for the admirable provision by which the scapula moves with it, thus preventing in a variety of instances the force of percussion from acting solely on the os humeri. Were the scapula fixed as is the pelvis, almost every violent motion of the arm would be attended with dislocation.

The head of the os humeri may escape from the glenoid cavity of the scapula in any direction except upwards, where the acromion and coracoid processes and the ligament connecting them together, prevent its ascent. Mr. Boyer observes, that there is "one species of luxation of the humerus of which though it has been described, and the possibility made evident, we are not acquainted with a single instance, it is the luxation outwards or backwards." Such a case occurred to Dr. Physick in December, 1811, and I have seen a luxation directly forwards, the head of the bone being lodged before the coracoid process, both of which will be noticed hereafter.

The situation of the bone after it has been dislocated is often changed very considerably by the action of muscles.

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* At the Hotel Dieu, of the total number of luxations, admitted during a long period of time, a majority were luxations of the os humeri. (Bichat.)

The dislocation downwards into the axilla, is by far the most frequent; the anatomical structure of the joint has furnished the French surgeons with some ingenious reasons for this, but they are of no importance in a practical point of view. It is probable that in every case where the head of the bone is found in the axilla, a considerable laceration of the capsular ligament must have taken place.

The symptoms of a dislocation of the os humeri downwards, are very easily distinguished. The principal difference observed between the luxated and sound shoulder, are the natural rotundity of the latter, and in the injured one a very remarkable depression under the acromion which of course appears very prominent; this symptom which was noticed by Hippocrates is never absent. The arm is longer than the sound one. Its direction is changed, and instead of hanging parallel to the side, it stands off at an acute angle from the body, and no effort of the patient can draw the elbow close to the side. Great pain is perceived in attempting to move the arm in any direction, but the motion outwards is less painful than any other. The head of the os humeri is felt in the axilla, forming a hard round tumour.

To reduce the bone, a vast variety of means have been employed; the ambé of Hippocrates is perhaps the oldest apparatus upon record: to recount the different inventions which have been contrived since his time would be a very useless and fatiguing task. I shall therefore very briefly describe the method which I believe best adapted to the case. It consists in making counter-extension against the acromion process of the scapula, and extension by the arm above the elbow, the fore-arm being flexed.

If the surgeon is called soon after the accident has happened, he is to press firmly with one hand against the acromion, and with his other grasping the arm above the elbow, forcibly to extend it, the patient being seated. In a great number of instances I have known this simple manœuvre to succeed instantly in reducing the bone, the strength of an individual being sufficient for the purpose.

If a greater length of time have elapsed, the extension and counter-extension are to be made in the same manner, but with additional power. Several assistants being employed, to make counter-extension against the acromion, by placing one hand over another, and an equal number to make extension.

When the force required is greater than can be thus applied, a girth or strong band covered with soft buckskin may be passed over the shoulder for counter-extension, and this can be held by assistants, or secured to a staple fastened in a wall; in order to prevent it from slipping, I have made use of two strips of muslin, one on each side of the shoulder, which are passed round the band, and held down by an assistant. To make extension, a piece of soft buckskin is applied round the arm above the elbow, and a strong towel is fastened upon this by very numerous turns of a muslin roller passed round and round the arm; to this towel, cords or bands may be attached, and any number of assistants can act upon them, or if pullies be necessary these can be affixed.

The advantage derived from the mode of applying force which has just been recommended is that it acts almost exclusively upon the shoulder joint. When the patient is secured by straps, bandages, or jackets about the thorax, the scapula moves with the humerus when this is pulled, and it would probably be possible to drag off the scapula and clavicle together with the arm, without reducing the luxation. The mode of treating the accident, by placing the heel in the axilla, and pulling at the arm, is a better plan, for in this case some of the counter-extension *is* borne by the scapula, and this has often been successful, but among the numerous methods which ingenuity has devised to aid in the reduction of a luxated humerus, I know of none which so completely and exclusively operates upon the affected part, and none which can succeed more happily than that which I have described.*

In general, the extension has not been long continued in this manner before the head of the bone in the axilla is found to move, and very often without any other effort, slips into its socket; if this, however, should not be the case, the surgeon is to take the fore-arm bent to a right angle with the arm, and with some force, rotate it repeatedly inward and outward. If the luxation be not reduced thus, pressure against the head of the bone, is to be made, directing it towards the glenoid cavity; if it can not now be pushed into its situation, the extensions may be suddenly suspended, and the surgeon having his left hand under the arm near the axilla, as suddenly depresses the patient's elbow towards his side and thus uses the os humeri as a lever and brings out the head of the bone to a level with the glenoid cavity which it consequently enters. By these means aided if necessary by copious blood-letting, the luxation has in every case I have yet seen been reduced.

Among the causes impeding the reduction of this luxation, Desault mentions "a narrowness in the opening of the capsular ligament," to enlarge which, he advises moving the arm very freely and forcibly in every direction. The same measure is useful also by tearing asunder any adhesions which may have formed in the new situation of the bone.

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* Mr. Freke, Benjamin Bell, Charles Bell, and other writers, recommend securing the scapula, but not in the manner here directed.

In all these efforts perseverance is an important rule. If the first attempts fail, they should be repeated, and varied again and again, and according to Desault even when success is not completely obtained, something will be gained if the head of the bone be brought nearer to the glenoid cavity, for "the motions of the bone will be the freer in proportion to its proximity to the natural situation."

At what period after its luxation should we consider it impracticable to reduce a dislocated bone? Did we believe B. Bell and other writers of the last century, a week or a fortnight having elapsed, all efforts should be considered as hopeless. Desault succeeded after three months. In a variety of instances Dr. Physick has succeeded after two and three months, and Dr. M'Kenzie of Baltimore, has replaced a dislocated os humeri nearly six months after its luxation. Before answering the question therefore, it may be well to consider another which I shall state in the language of Dr. Physick, quoted from his lecture on this subject. "If force applied can remove a bone from its natural to an unnatural situation, why may not force be so directed as to remove it from this new, to its former position?" If the time could be ascertained at which the socket is certainly filled up, and its texture completely altered, that would be the time to give over all attempts at reduction.

The plan we have recommended is proper in most cases of dislocated os humeri. In the dislocation *backward*, (a very rare accident, which neither Desault nor Boyer ever saw,) in addition to the extensions and counter-extensions, some pressure should be made upon the head of the bone, and an attempt to push it towards its socket whilst the extension is made. Dr. Physick in this manner succeeded in reducing a case of the kind, without difficulty. It was distinguished by a great depression under the acromion, as in all other dislocations; by a hard tumour on the dorsum of the scapula which was evidently formed by the head of the bone; by an inability to move the arm, in any direction; and by an absence of the head of the bone from the axilla. No doubt could exist as to the nature of the accident, and no difficulty was experienced in its reduction.

It is astonishing that Mr. Charles Bell should deny positively the possibility of this accident. "No force can be applied in a direction to dislocate the humerus and push its head behind the scapula, for *this very evident reason* that the chest prevents the necessary position of the humerus."* Mr. Bell's accurate anatomical knowledge should have taught him that the chest is no defence to the shoulder, and that a blow on the shoulder can luxate the humerus, as readily as a twist of the arm. In the case recited the patient fell through a hatchway and struck the fore part of the shoulder which was thus pushed directly backwards.

A case of dislocation inwards and forwards occurred to Dr. Physick in 1812; there is no reason for believing this to have been consecutive, for the head of the bone continued unmoved after the accident, and assumed the situation in which he found it, immediately after escaping from the glenoid cavity. As the head of the bone in this case, was fixed between the glenoid cavity and the coracoid process, extension was made by drawing the elbow backwards and downwards, and counter-extension, by pressing the acromion scapulæ forwards and inwards towards the head of the bone, at the same time a band was passed under the arm by which the upper end of the os humeri was dragged outwards so as to unhitch it from the coracoid process. By these means, after in vain trying extension in the usual way, the reduction was effected.

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* Operative Surgery, Vol. II.

In another instance of luxation forwards and inwards, the head of the bone passed completely over the coracoid process, and was situated directly under the clavicle. In this case by bleeding ad deliquium, and extending the arm at a right angle from the body, the reduction was easily effected.

After the reduction of a dislocated os humeri the arm should be kept at rest, and if inflammatory symptoms occur, they are to be treated by the usual remedies.

Many of the preceding remarks are taken from Dr. Physick's MS. lectures. I am well aware that the idea of making *some* counter-extension against the acromion is to be found in several writers. Mr. Charles Bell and Boyer, appear to come nearer the plan above proposed than any others, but their methods are different in many particulars: Mr. Hey in his practical observations has some excellent remarks on this luxation, but they are detailed with less than his usual perspicacity. The great object to be kept in view, is to act as effectually as possible on the shoulder joint, and this can best be done by making the counter-extension as nearly as possible to the glenoid cavity, and this can certainly be accomplished by making counter-extension *exclusively* upon the acromion process.

An accidental circumstance which occasioned some alarm to Desault in attempting a difficult reduction, it may not be improper to notice in this place; the sudden formation of a very considerable tumour at the upper part of the arm, occasioned probably by the rupture of a vein, as it subsided in a fortnight, leaving a large ecchymosis: no particular injury resulted from it, though at first it was mistaken by some, for an effusion of air from the thorax, and by others, for a rupture of an artery.

The stiffness of the joint which follows a luxation of the os humeri is generally of short continuance, and its motions are soon perfectly restored. The arm should be gently moved after a few days have elapsed, and these motions are to be gradually increased.

CHAPTER XLI.

Dislocations of the Fore-arm.

The radius and ulna may be dislocated from the humerus; or secondly, The superior extremity of the radius may be separated from the ulna; or thirdly, The ulna may be luxated at its inferior extremity from the radius.

1. The articulating surfaces which form the elbow joint are very extensive, and the joint consequently possesses considerable strength, which is augmented by the muscles passing over it and connected with the bones in its vicinity. The elbow joint possesses the true hinge-like motion, and is a pure specimen of the articulation denominated ginglimus. From these circumstances it is not frequently dislocated. The luxation may take place, however, backwards, and laterally. The luxation backwards is most frequent. A complete dislocation laterally cannot take place, from the great extent of the articulating surfaces in this direction, and the strength of the muscles and ligaments around the joint.

"In the luxation backwards the radius and ulna may ascend more or less behind the humerus, but the coronoid process of the ulna is always carried above the articular pulley, and is found lodged in the cavity destined to receive the olecranon. The head of the radius is placed behind and above the external condyle of the humerus. The annular ligament which confines the superior extremity of the radius to the ulna may be lacerated, in which case even when the bones are reduced, it is difficult to keep them in their proper places, as the radius tends constantly to separate from the ulna.

"This luxation always takes place from a fall on the hand; for when we are falling we are led by involuntary instinct to bring our hands forwards to protect the body. If in this case the superior extremity instead of resting vertically on the ground, be placed obliquely, with the hand nearly in a state of supination, the repulsion which it receives from the ground will cause the two bones of the fore-arm to ascend behind the humerus, whilst the weight of the body pressing the humerus obliquely downwards forces its extremity to pass down before the coronoid process of the ulna.

"The fore-arm in this luxation is in a state of demi-flexion, and every attempt to extend it, occasions smart pain. The situation of the olecranon with respect to the condyles of the humerus is changed. The olecranon which in the natural state is placed on a level with the external condyle, which is itself situated lower than the internal, is higher than it.

"This luxation may be mistaken for a fracture of the olecranon, of the head of the radius, or even of the lower end of the humerus: such a mistake is attended with very bad consequences; *for if the reduction be not effected before the end of fifteen or twenty days, it is impossible to accomplish it afterwards.** The swelling more or less considerable which supervenes in twenty-four hours after the accident, renders a diagnosis difficult; the bony prominences are so covered by it, that it is impossible to examine their respective situations. Besides, the rubbing of the coronoid process and olecranon against the humerus, causes a grating noise similar to that in fracture. From these circumstances it must appear, that much attention is requisite to establish a diagnosis between the fracture of the head of the radius, and a dislocation of the fore-arm backwards." (BOYER.)

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* This is a great mistake of Mr. Boyer. I have seen a case of this luxation which had continued longer than a month, very promptly reduced.

The reduction is effected by seating the patient in a chair, and making extension and counter-extension by two assistants, one of whom grasps the wrist and the other the arm near the shoulder. The surgeon now interlocks his fingers in front of the arm just above the elbow and draws it backwards. If greater force be necessary it is to be applied in the same directions. Boyer recommends that the olecranon be pressed forwards and the humerus pulled backwards by the surgeon, who is to place the four fingers of each hand on the fore part of the humerus, and his thumbs on the olecranon. The only objection to the plan is, that the surgeon unless a Hercules, could not in this way act with sufficient power, and if the humerus be forcibly drawn backwards, there will be no necessity for pushing the olecranon forwards. When the reduction is effected, the form and motions of the elbow will be restored and a very evident noise will be heard at the moment when it takes place. Rest and a low diet should be observed for a few days after the accident, the fore-arm being preserved in a state between flexion and extension by a roller and compresses or splints. A week after the accident the arm should be gently and repeatedly moved to prevent anchylosis; these motions are to be daily increased, until they are performed perfectly and without pain.

"In a luxation of the fore-arm backwards the annular ligament which confines the head of the radius to the extremity of the ulna, is sometimes torn, and the radius passes before the ulna. In such cases, the motions of pronation and supination, are difficult and painful, though the principal luxation has been reduced." The head of the radius may be easily replaced by pressing it from before backwards, and it is kept in its place by compresses bound on the superior and external part of the fore-arm by a roller passed round the elbow in form of the figure 8.

When the luxation has not been reduced, the superior extremities of the bones, grow to the posterior part of the os humeri, and flexion and extension are thus precluded. In young subjects a slight degree of motion is sometimes regained.

The lateral luxation, either inwards or outwards, is easily detected and easily reduced, the reduction is effected by moderate extension, and whilst this is made, by pressing laterally the projecting parts of the humerus and fore-arm. If no great degree of contusion exists the arm requires no dressing, but to be supported in a sling.

Besides these dislocations the fore-arm may be luxated forwards, but in that case, the olecranon process must be fractured, and the case, therefore, is to be treated as a fracture of the olecranon. The reduction is readily effected.

In all these accidents to the elbow, inflammation supervenes, and must be remedied by bleeding and a low diet.

2. The head of the radius is in some cases dislocated from its articulation with the ulna. In general the luxation takes place backwards. The hand is found in a state of pronation, and cannot be moved out of it without great pain. The head of the radius is found projecting at the external side of the olecranon. There is a considerable depression felt at the part where the head of the bone is naturally situated.

To replace the luxated bone, the head of the radius is to be pushed from behind forwards, and the hand of the patient is at the same time to be brought to a state of supination. The reduction is thus effected, and an audible noise is produced by the re-entrance of the head of the radius into the sigmoid cavity of the ulna. The hand regains the power of rotation; the ligament in this instance being ruptured, it will be some time before the joint recovers its motions perfectly, and gentle motion is to be frequently made, after the lapse of a few days from the accident. The limb may be surrounded at the joint by a few turns of a roller, and this may be wet with a saturnine lotion.

3. The inferior extremity of the ulna is occasionally dislocated from its connection with the radius. It may be pushed either forwards or backwards, most commonly backwards. This dislocation is easily distinguished. The hand is kept continually in a state of *pronation*, and this position cannot be changed; a tumour is felt *behind* the lower extremity of the radius; the hand is turned a little inwards, and there is an evident depression where the lower end of the ulna ought to be situated. The reduction is easily effected, by pulling the arm and turning it a little inwards, whilst the lower end of the ulna is pushed backwards, and that of the radius forwards, the hand being at the same time placed in a state of supination. A roller wet with a solution of sugar of lead is to be applied after the reduction, and the hand supported at rest in a sling.

The dislocation anteriorly is more rare. It is known by the hand being in a continued state of *supination* and it cannot be placed in a state of pronation: a tumour is felt *before* the radius, and there is an empty space where the lower end of the ulna should be. The ulna crosses the radius obliquely instead of being parallel with it. The reduction is effected as the preceding luxation, except that the hand must be moved in a contrary direction.

If the parts be much swollen before the surgeon is called, in this as in all similar cases, he should wait until the inflammation is somewhat abated before making any attempt to reduce the bone.

CHAPTER XLII.

Dislocations of the Hand.

"Four kinds of luxations may take place in the articulations of the bones of the carpus with the inferior extremities of those of the fore-arm, viz. luxation forwards, backwards, inwards, and outwards. But the two first, especially that backwards, are the most frequent, because the motions of flexion and extension are much more extensive than those of adduction and abduction, and because the extent of the articulating surfaces is greater from within to the outside, than from before backwards; besides, the styloid apophyses of the radius and ulna, strengthen the external and internal sides of the articulation, and render dislocation in the transverse direction still more difficult.

"The articulation of the hand with the fore-arm is remarkable in this, that it admits of flexion and extension nearly to the same extent; whilst these two motions, in all the other articulations, have rarely the same latitude, that of flexion being always the most considerable.

"Luxation backwards is facilitated by the direction of the convex articulating surfaces of the scaphoides, lunare, and cuneiforme, which, inclined more backwards than anteriorly, must be more disposed to slide in this direction than in any other. It is caused by a fall on the back of the hand while much bent; in which case the first range of bones of the wrist slides backwards into the oblong cavity of the two bones of the fore-arm, extends and lacerates the posterior ligament, and forms an eminence behind the ends of the radius and ulna. This tumour, the depression at the anterior part of the wrist, and the extraordinary flexion of the hand which cannot be extended, are the distinguishing marks of this luxation. It is reduced by fixing the fore-arm, and drawing the hand, whilst pressure is made on the eminence formed by the displaced carpus to force it back into its cavity. An assistant fixes the arm, and the surgeon makes extension and adjusts the bones.

Luxation forwards is occasioned by a fall on the palm of the hands, the fingers being extended and more force being applied to the inferior part of the palm than to the superior. It is rarely complete; the hand remains painfully extended, and cannot be restored to its natural direction without some difficulty. The numerous tendons which pass before the wrist, and the annular ligament which confines them, being pushed forwards, render it so difficult to discover the eminence formed by the bones of the wrist before the ends of those of the fore-arm, that this affection may be easily mistaken for a sprain. Consequently, in all doubtful cases, we should proceed as if the luxation had really taken place, and bring the hand into its proper direction.

"Luxations backwards, but especially those forwards, are always accompanied with a more or less considerable laceration of the ligaments, and are followed by an inflammatory swelling difficult to subdue; hence, the full use of the wrist is not recovered for a considerable time. When the bones are reduced, the remainder of the treatment is the same as in cases of sprain: refrigerants and repellents are to be first used, and then emollients and resolvents. The patient must not fatigue the hand much, even for some time after complete recovery, lest he excite inflammation, and lay the foundation of a white swelling.

"Luxations inwards, and those outwards, are never complete. The laceration of the ligaments, a tumour at the internal or external side of the joint and distortion of the hand, are the concomitant symptoms of these luxations, and mark them out sufficiently. They are reduced by making gentle extension, and causing the two surfaces of the joint to slide on one another in a direction contrary to what they took in luxating, and by bringing the hand into its natural situation. The danger of these luxations depends less on the dislocation than on the straining or laceration of the soft parts, which are always followed by more or less tumefaction, a symptom difficult to subdue, and often the cause of anchylosis or even of caries."

LUXATIONS OF THE BONES OF THE CARPUS AND METACARPUS.

" The motions of the bones of the carpus and their articulations with one another are so limited, and the connection is so strong, that a dislocation of them appears entirely impossible. However, the head of the os magnum, which is received in a deep cavity formed for it by the scaphoides and lunarenaris, may escape from this cavity, be luxated backwards by too great a flexion of the bones of the first range on those of the second, and form a tumour on the superior part of the back of the hand. Boyer and Desault have both seen cases of this accident.

" As to the bones of the metacarpus, they are connected so closely and strongly, and support one another so firmly in efforts made against the palm of the hand, that they are never luxated. The ligaments of their articulations may, however, be overstretched and torn, and a painful diastasis produced, which will require the use of emollients and resolvents, with immobility of the hand as long as the affection continues.

" Notwithstanding the mobility of the articulation of the trapezium with the first bone of the metacarpus, the latter is luxated but very rarely. Efforts made in the thumb which is supported by this bone, would produce rather a luxation of the first phalanx, than that of the metacarpal bone. The second and third bones are so firmly articulated with one another, and with the bones of the second row of the carpus, that they are not susceptible of any luxation whatever. As to the fourth and fifth, a little more moveable, and supported by the os unciforme, their articulations are more susceptible of sprains than true luxations."

LUXATIONS OF THE FINGERS.

"The first phalanges may be luxated backwards at their articulations with the bones of the metacarpus. A luxation of them forwards would be very difficult, if not altogether impossible, on account of the disposition of the articulating surfaces of the metacarpal bones, which are much elongated forwards, and allow a great extent of motion to the phalanges in this direction, without losing contact with them; and on account of the resistance made by the palm of the hand, which would restrain the flexion carried beyond what the inclination of the articulating surfaces would admit of. Luxations inwards can take place only in the first phalanges of the thumb and little finger: as to that outwards, the first phalanx of the thumb alone is susceptible of it. This phalanx is also the most exposed to luxations backwards. When a violent effort is made on the thumb from before backwards, its first phalanx slips behind the head of the first metacarpal bone, and remains extended, while the second is bent, its flexor-muscle being thrown into action by the irritation. The distortion of the thumb, the impossibility of bending the first phalanx, and the pain, render this luxation sufficiently evident.

"The more violent the effort necessary to produce these luxations, the more grievous are their consequences. In some persons in whom the ligaments are excessively relaxed, they produce no inconvenience. In such, the first phalanx of the thumb may be luxated at will; but then it is as easily reduced as displaced.

"These luxations should be quickly reduced, for, at the end of eight or ten days, they are irreducible. Desault in a case of this kind, proposed making an incision behind the superior extremity of the phalanx, and by means of it to introduce a spatula, in order to push the phalanx into its place; but the patient frightened at the operation, would not submit to it. Citizen Boyer has also observed in a hair-dresser, a luxation backwards irreducible from having continued too long.

"The reduction is not as easy as one might imagine. The number and force of the muscles which are inserted into the first phalanx of the thumb, and the little hold we can take of this part in order to make extension, render the reduction difficult. Luxations of the first phalanges of the thumb and little finger inwards, that of the thumb outwards, and luxations of the first phalanges of the other finger backwards, are all reduced by making extension on the inferior extremity of the affected finger, round which a fillet is to be passed if there be occasion for much force. The wrist is fixed by an assistant, who makes counter-extension, and the surgeon replaces the bone. The first and second phalanges are also susceptible of luxation backwards, which only differs from the former by being more easily reduced. After the reduction is accomplished a roller is put round the finger to prevent a return of the luxation." (Boyer.)

To the preceding remarks from Boyer I shall add a very few respecting the dislocation of the thumb: Mr. Hey observes, that "a peculiar difficulty attends the reduction, when the head of the metacarpal bone which is joined to the first phalanx of the thumb, is luxated completely and depressed towards the palm of the hand. A dislocation in the opposite direction, is easily reduced." Mr. Hey attempts an explanation of the difficulty, from the manner in which the lateral ligaments are connected with the extremities of the bones concerned in this luxation; these ligaments are connected with the two tubercles, which are situated on each side of the anterior extremity of the metacarpal bone; upon measuring the distance of these tubercles from each other, Mr. Hey found "those two, which are nearest the palm of the hand, to be three-eighths of an inch from each other, while those on the posterior part are distant five-eighths: supposing, therefore, the head of the metacarpal bone to be pressed forcibly between the lateral ligaments towards the palm of the hand, the extremity of the metacarpal bone passes like a wedge between the lateral ligaments, and having passed through them, it cannot return, as the posterior broad part of the bone presents itself to the more contracted aperture between the ligaments. From an anatomical consideration of this joint, it seems impossible that the metacarpal bone should pass in this direction to a complete dislocation without tearing off some part of the lateral ligaments; yet so much of the ligaments remains, as to prevent the return of the bone to its natural situation."

Mr. Hey himself, experienced great difficulty and was foiled in an attempt to reduce this dislocation. He witnessed also the want of success in other celebrated surgeons, and states on the authority of Broomfield that the thumb was actually torn off at the second joint without effecting the reduction. Under these circumstances, the plan suggested by Desault of cutting open the joint, would surely be warrantable, since we know that incised wounds of these joints when properly treated seldom occasion any ill consequences. Mr. Charles Bell has, however, proposed a plan to which I conceive there can be no valid objection in these obstinate cases; the introduction of a couching needle obliquely under the skin, so as to cut one of the lateral ligaments, this would in all probability very quickly liberate the confined bone and permit its easy reduction.

The first case of this accident I ever saw, although attended with great difficulty, was eventually reduced by Dr. Physick. I have, since the publication of the first edition of this work, met with two other instances. The first I reduced with great difficulty, the second (in a child) very readily.

CHAPTER XLIII.

Dislocations of the Thigh.

FROM a consideration of the structure of the hip-joint, in a skeleton, it would appear extremely difficult to effect a dislocation of the os femoris, and this difficulty is greatly augmented by the cartilages and ligaments connected with the articulation; notwithstanding, however, these powerful obstacles, the accident not unfrequently happens. Mr. Boyer is of opinion, that it is more rare than has been supposed, and believes that authors have frequently mistaken fractures of the neck of the os femoris for dislocations. The experience of many practitioners is, however, opposed to the opinion of Boyer, concerning the comparative frequency of the two accidents. So far as my own limited observation has extended, I have witnessed about three luxations at the hip, for one fracture of the neck of the os femoris.[*] Mr. Hey says he has seen but six cases in a practice of forty-three years, during thirty-four of which he attended a large infirmary; this, however, is what few surgeons of equal experience can declare.

The dislocation may take place, upwards and backwards (or upwards and outwards) on the dorsum ilii; secondly, upwards and forwards on the os pubis; thirdly, downwards and inwards into the foramen thyroideum; fourthly, downwards and backwards on the os ischium. Some variety exists in the situations of the bone in these four kinds of luxation generally described; I have seen a luxation directly forwards, differing somewhat from the second species, but yet not in any very important respect. I have also seen a luxation directly backwards.

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[*] I have had now (1818,) occasion to see this proportion altered, but still have witnessed many more luxations than fractures. Mr. Astley Cooper states the proportion of fractures of the neck of the thigh bone which he has seen to be at least four, to one of dislocation.

The most frequent of these accidents are the first and third, and of these it is not easy to ascertain the most common. The luxation outwards and upwards I have met with much more frequently than any other, though I have seen all except the fourth species which is extremely uncommon, and perhaps never occurs directly, but is owing to a subsequent change in the position of the head of the bone from the action of muscles drawing it downwards.

A LUXATION UPWARDS AND BACKWARDS is described very accurately by Boyer.

"When by a fall from a place more or less elevated, on the soles of the feet, or on the knees, the thigh is pushed forwards and inwards, the head of the femur, forced towards the superior and external part of the acetabulum, breaks the internal and orbicular ligaments, escapes through the laceration in the latter, and ascends on the external face of the os ilium; but as the part of the os ilium immediately above and at the external side of the cavity, is very convex, the head of the femur soon abandons its first position, and slides backwards and upwards into the external fossa of the os ilium, following the inclination of the plane towards this fossa, and obeying the action of the glutæi muscles which draws it in this direction. The head of the femur, in ascending thus on the external face of the os ilium, pushes upwards the glutæus minimus, which forms a sort of cap for it; and the glutæus maximus and medius are relaxed by the approximation of the points into which they are inserted. The pyriformis is nearly in its natural state, the gemini, obturatores, and quadratus femoris, are a little elongated. The psoas magnus and iliacus internus are relaxed, as are also the other muscles inserted into the trochanter minor. If to this description it be added, that the orbicular ligament, torn at its superior part, is stretched over the acetabulum and covers it, an exact idea may be formed of the change occasioned in the surrounding parts by this luxation of the femur. The affected thigh is shorter than the sound one: it is a little bent, and carried inwards. The knee inclines more forwards and inwards than the opposite one; the leg and thigh are turned inwards, and the foot points in this direction. The trochanter major is brought nearer the anterior and superior spinous process of the os ilium, and is at the same time elevated and carried a little forwards; the latter circumstance may be considered as the necessary consequence of the rotation inwards of the thigh. The natural length of the limb cannot be restored without reducing the luxation: the foot cannot be turned outwards, and any attempt to do so causes pain; but the inclination of the foot inwards may be increased. If the patient endeavours to walk, he extends the foot to put the top of it on the ground; and though he is raised, he is still lame; for the diseased limb remains always shorter than the other, and the pain occasioned by the attempt to walk renders progression still more difficult.

"Luxation of the femur upwards and outwards has nothing in common with the fracture of the neck of this bone but the shortness of the limb. The easy rotation of the member outwards and inwards, &c. &c. preclude all possibility of confounding them, unless the surgeon be remarkably inattentive.

"It is difficult to assign the cause of the foot and remainder of the limb being turned inwards in this luxation. It may be established as a general rule, that luxated members always take a direction determined by the elongation of the muscles of the side opposite that to which the luxated bone is carried; thus in luxation of the arm downwards and inwards, the deltoides and infra-spinatus muscles, lengthened by the separation of their points of insertion, move the elbow out from the body, and give the arm an oblique direction. In this case, the obturatores, gemini, and quadratus femoris, being elongated, the point of the foot ought to be turned outwards. This phenomenon depends perhaps on the external portion of the orbicular ligament which comes from the anterior and inferior spine of the os ilium; this portion, which is very thick, being elongated in the luxation outwards, draws the great trochanter forwards, and consequently turns inwards the entire limb."

Luxations of the thigh bone are generally extremely difficult of reduction, from the powerful action of the muscles surrounding the joint, and from the peculiar construction of the articulation itself. To effect the reduction of the first species of dislocation (upwards and backwards) the patient is to be placed on his back upon a table covered with a mattress, or with folded blankets. A strong band is to be passed between the pudendum and the luxated thigh in such a manner as to press upon the ischium, and this band is to be secured firmly to a post or staple, or it may be held by a sufficient number of assistants; in this manner *counter-extension* is made by fixing the pelvis. The *extending* force is to be made by securing a folded sheet or strong band above the knee by means of a roller passed tight round the limb at this place; this band is to be delivered to a sufficient number of strong assistants. The surgeon directs the extension to be made, and with his hands presses upon the trochanter and endeavours to direct the head of the bone towards the acetabulum. In recent cases this simple plan is often completely successful. The head slips into its cavity with a very audible noise, and the symptoms of dislocation immediately cease.

If this measure, however, should fail, as it sometimes does, the head of the bone must be pulled *outwards*, (that is, more remote from the centre of the body.) The object of this motion *outwards* is to raise the head of the bone to a level with the high margin of the acetabulum, over which it must pass in order to regain its natural situation. The means of effecting it are to place the patient upon his side, and to pass a band under the thigh; an assistant places his knee upon the crista of the os ilium and thus prevents the pelvis from moving in a lateral direction; the band may be tied over his shoulder by which he will be enabled very conveniently to draw the thigh outwards; or he may place one foot (without a shoe) upon the pelvis, and draw with his hands the lateral band; the extension and counter-extension, as previously directed, are to be continued, and the surgeon is to bend the leg to a right angle with the thigh, and rotate the limb backwards and forwards. This plan is generally successful. A variety of measures have been devised by which extension in the directions just described may be made, pullies may be substituted for assistants; bed-posts may be used for counter-extension, &c. Numerous plans suggested by the circumstances of each particular patient have been found successful.

A low diet should be enjoined for several days after the reduction of the bone, and the patient should remain at rest for a considerable time. The round ligament probably never completely unites after this accident, and consequently the joint remains always weak.

THE LUXATION DOWNWARDS AND INWARDS into the foramen thyroideum, is the next in point of frequency. I shall quote the description of this accident from Boyer.

" It is favoured by the great extent of the motion of abduction of the thigh; by the notch at the inferior and internal part of the acetabulum; by the weakness of the orbicular ligament at this side; and lastly, by the situation of the round ligament, the rupture of which is not a necessary consequence of it. It is occasioned by a fall on the feet or knees considerably separated from each other. The head of the femur slides from without inwards on the bottom of the acetabulum, and comes against the inferior and internal portion of the orbicular ligament, which it lacerates and passes on to the foramen ovale between the ligament and the obturator externus.

"In this species of luxation of the femur, the state of the soft parts surrounding the articulation is as follows: the glutæi, gemini, obturatores, quadratus femoris, psoas magnus, and iliacus internus, are elongated by the separation of their points of insertion. The rotation of the limb outwards is produced by the elongation of these muscles. The adductors, elongated, form at the interior part of the thigh a tense cord, which is felt from the pubis to below the middle of the thigh.

" The affected thigh is longer than the sound one; the head of the femur being placed lower than the acetabulum, the great trochanter is removed to a greater distance from the anterior and superior spinous process of the os ilium, and the thigh is flattened in consequence of the elongation of the muscles. The adductors, extended obliquely from the pubis to the femur, form a cord which elevates the skin of the internal part of the thigh. A hard round tumour is felt at the inner and superior part of the thigh, formed by the head of the femur, which elevates the soft parts situated before the foramen ovale. The leg is slightly bent; the knee and foot turned outwards, cannot be brought back to their proper direction. If the patient attempts to walk a few steps, he makes a semicircular motion with the foot, and places at once the entire sole on the ground; and though he keep the knee bent, still the limb is too long, and occasions lameness. The mode of progression of persons whose thigh is luxated in this direction may be compared to that of a mower:—the elongated extremity, like the leg which the mower keeps forwards, describes a semicircular motion outwards.

"All these symptoms taken together form a combination too striking to admit of error in our diagnosis, or to allow us to confound this luxation with any other, or even with fracture of the neck of the femur.

"The prognosis is somewhat less favourable in this than in luxation upwards and outwards. The muscles, which might oppose the reduction, being all elongated by the very circumstance of luxation itself, renders the reduction easier; besides the contusion of the soft parts is less considerable, and the round ligament is stretched, but not broken."

The reduction is to be effected in the same manner as that of the luxation last described.

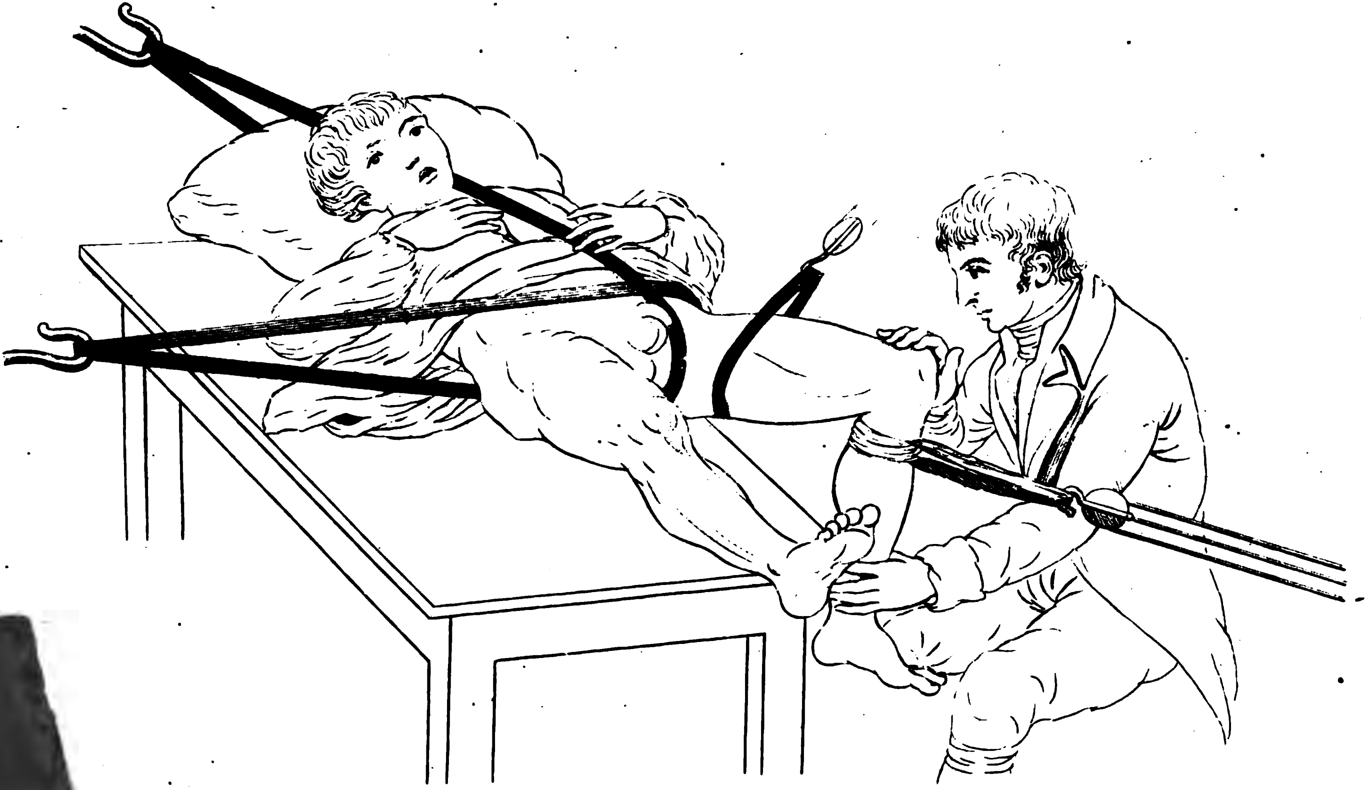
The luxation upwards and forwards is very rare; Desault describes a case of it, and I had myself an opportunity of seeing a case which Dr. Physick has published. In the latter the luxation was not precisely similar to Desault's, the head of the bone being not at all higher than the acetabulum. I shall relate this case as illustrative of the nature and treatment of the accident.

"In February 1805, a man was brought to the Pennsylvania Hospital, in consequence of a dislocation of the thigh bone at the hip-joint, which had taken place the day before in the following manner. As he was riding on a sled, which was drawn rapidly along, with his legs extended over its side, the foot of his left leg became entangled in the gears of a team of horses standing in the road. A great abduction of the leg and thigh was suddenly made, by which the head of the bone was forced out of its socket, and lodged on the os pubis, directly before the acetabulum. In this situation it formed a tumour, plainly to be seen and felt in the groin, under Poupart's ligament. The foot and knee were turned outward, the thigh was extended with the leg bent backward. By a very particular examination it appeared that the dislocated limb was a little longer than the other, though the difference in length was very inconsiderable.

"After an unsuccessful attempt, which is unnecessary to describe, the head of the bone was replaced by the following means.

"The patient being laid on his back on a table covered with a mattress, a firm strap was placed behind his thighs, and the ends of it being carried upwards, before and behind his body, were fastened to a staple opposite his left shoulder, for the purpose of fixing the pelvis, and making the counter-extension. This strap was applied in such a manner as to act as much as possible against the injured side of the pelvis, and was carried, therefore, between the dislocated thigh and scrotum, and then over the tuberosity of the ischium of the same side. A strong towel was then fastened with a roller upon the leg just below the knee, and the leg was bent to a right angle with the thigh. The ends of this towel were tied together, and a pulley was hooked to it for the purpose of making the extension.

"In order to draw the head of the bone directly outwards, a firm strap was passed over the pelvis below the crista of the ilium of the injured side, and the ends of it fastened to a staple opposite the sound side of the patient's body. Another strap was applied over the upper part of the dislocated thigh, the ends of which were fastened to a pulley opposite the injured side of the patient.



"After the application of this apparatus, before commencing the extensions, the man was copiously bled, with the intention of causing him to faint, an effect, however, which was not fully produced, though he lost a considerable quantity of blood, by which he was much weakened. In this state of debility the extensions were repeated, and at the same time the leg being bent, was moved inwards and outwards, so as to rotate the thigh bone as much as possible and thereby to assist in dislodging its head. To prevent the abduction of the thigh by the strap over its upper part, the knee was pressed inwards by the hand of an assistant applied on its outside.

"In this manner several attempts were unsuccessfully made, but, added to the bleeding, they exhausted the patient's strength so much, that his body became covered with a cold sweat. In this state of weakness the extensions were directed to be again repeated with greater force than had been before employed, and by these the head of the bone was suddenly reduced to its natural situation. The patient in a few minutes recovered sufficiently to move his thigh in every direction, suffered very little pain afterwards, and was discharged from the hospital, cured, in three weeks."*

In Desault's case the following were the symptoms: "the limb was nearly an inch shorter than natural. The point of the foot was turned outwards, the thigh being in a state of painful extension could not be flexed on the body; adduction and abduction were alike painful; the great trochanter being more approximated than usual to the anterior superior spinous process of the ilium, was also too far forwards; finally, the projecting head of the bone could be felt in the groin." The mode of reduction which succeeded differed but little from that employed by Dr. Physick, the chief circumstances in which the plan of Desault differs from that which we would recommend, are that Desault applied extension at the ankle, and counter-extension on the sound side of the pelvis, and not on the side where the dislocation existed. Dr. Physick's plan appears calculated to act more directly and powerfully on the luxated joint. If the one, however, should fail, the other ought unquestionably to be tried.

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* Medical Musuem—vol. 1.

THE LUXATION DOWNWARDS AND BACKWARDS I have never seen, and shall quote Boyer's history of it.*

"Luxation of the femur, downwards and backwards may be either primary or secondary. It is primary, when in consequence of some effort, the head of the femur is forced from the acetabulum at its inferior and posterior part, and is placed at the junction of the os ilium and ischium; it is secondary, when it succeeds to the luxation upwards and outwards, the head of the femur, which was placed at first in the external iliac fossa, sliding downwards and backwards, its passage in this direction being favoured by the binding of the thigh on the pelvis.

"In these two cases, the head of the femur rests upon that part of the ossa innominata, where the os ilium and ischium join. The muscles which cover the posterior part of the articulation, such as the pyriformis, gemini, obturatores, and quadratus femoris, are raised up and stretched; the psoas magnus and iliacus internus are in a great state of tension, and this explains the turning of the limb outwards. When this luxation is primary, the extremity is lengthened; a hard tumour is felt at the posterior and inferior part of the thigh, the great trochanter, by descending, is removed further from the spine of the os ilium, and the knee and sole of the foot are turned outwards; but if it be secondary, the thigh is much bent against the pelvis; the knee and sole of the foot are turned inwards, because the primary luxation has been upwards and outwards. Secondary luxation in this direction is much more frequent than the primary: in reducing it, the same rules are to be observed as in other species of luxations."

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* Mr. Astley Cooper states, that he has never seen it, and supposes mistakes to have arisen on the subject, though he does not positively deny its possibility. Surgical Essays, 1818.

A primary luxation directly backwards was brought into the Pennsylvania hospital last winter, and after various attempts to reduce it by powerful extension, in the different directions before described, Dr. Physick thought it probable that the head of the bone had slipped through a slit or longitudinal rent in the capsular ligament, and that this rent embraced it at the neck, as a button hole does a button; under this impression after the extensions had ceased, he made an ABDUCTION of the thigh, bent to a right angle with the body, pushing at the same time the head of the bone forwards towards the acetabulum; this manœuvre in a moment succeeded without any more force than the Dr. was himself able to exert—a strong confirmation of his opinion respecting the nature of the obstacle previously existing. In all difficult cases it will be proper to try every possible motion of the limb, before abandoning the case as hopeless; very often after great force has failed, a gentle effort in some new direction is found successful.

When a luxated thigh bone remains long unreduced a new joint is formed in the situation where the head of the bone is lodged, and a considerable degree of motion is regained. The acetabulum lessens in size and is eventually obliterated. When the luxation is upwards and backwards an imperfect joint forms on the dorsum ilii, and of course the limb is considerably shortened and the patient is very lame, walking principally on the toes and anterior part of the foot, sometimes he avails himself of a high heeled shoe. If the luxation be forward and downward the foramen thyroideum forms part of the new articulating cavity and the limb is rather longer, the patient walks much better than in the preceding case. Dr. Wistar has preserved in his collection very interesting specimens of new joints formed in consequence of unreduced luxations of the os femoris.

Spontaneous dislocations of the os femoris are those in which the head of the bone has been protruded by pus, granulations, or tumefaction, in the acetabulum. It can occur only in cases of extensive disease of the hip-joint, and is of little moment compared with the disease of which it is a symptom—this we shall describe more particularly hereafter.

CHAPTER XLIV.

Dislocations of the Patella.

The patella is occasionally forced over one of the condyles of the os femoris, and is thus luxated laterally. A dislocation upwards or downwards cannot take place without a rupture of the extensor tendon of the leg, which reduces the accident more nearly to the nature of a fractured than of a dislocated patella, and is to be treated like the former case.

The lateral dislocation is most frequent outwards. The patella is found to have deserted the anterior part of the knee, and a depression is felt at the place where it is usually situated. The internal edge of the patella presents anteriorly, the external, posteriorly; the anterior flat surface faces outwards, the posterior smooth articulating surface inwards, being thinly covered; all these symptoms are very obvious. I have known this accident occur in dancing: a young lady in attempting some difficult step suddenly felt a great pain in her knee, and was unable to move it. Dr. Physick was sent for and discovered a luxation of the patella characterized by the preceding symptoms; it was reduced in a moment by extending the leg, flexing the thigh on the pelvis, and pushing the luxated bone back to its natural situation—a plan which generally succeeds very speedily in effecting a reduction of a dislocated patella.

In some instances much trouble is experienced in effecting the reduction: Sabatier was foiled in attempting it, and Boyer who was called in, found great difficulty though he eventually succeeded. I have myself experienced much difficulty in such a case. A young lady in stepping into bed dislocated the patella laterally, and although I saw her within five minutes after the occurrence of the accident, it occasioned me no small embarrassment. After many fruitless efforts I at length succeeded, but not by any particular exertion of force or skill, and I cannot describe the motion which effected it.

Sometimes after the reduction, the bone is not easily kept in its situation; in all such cases rest should be enjoined, and a bandage, or laced knee cap, should be applied, with a compress on the outside of the knee to prevent the escape of the bone from its central situation.

When the luxation is inwards the symptoms differ only in the situation of the bone. The reduction is effected in a similar manner; a blow on the outside of the knee generally occasions the accident.

CHAPTER XLV.

"*Of internal derangement of the Knee Joint.*"

Mr. Hey is the author of some interesting observations on an accident which may not improperly be considered a species of dislocation. I shall, therefore, quote them in this place.

"The knee joint is so firmly supported on all sides by tendinous and ligamentous substances, that the bones of the thigh and leg are very rarely separated from each other, so as to form a *dislocation*, in the common sense of the term. Great violence must take place and a considerable laceration must happen, before the tibia can be completely separated from the os femoris. Yet this joint is not unfrequently affected with an internal derangement of its component parts; and that sometimes in consequence of trifling accidents. The disease is, indeed, now and then removed as suddenly as it is produced, by the natural motions of the joint, without surgical assistance: but it may remain for weeks or months, and will then become a serious misfortune, as it causes a considerable degree of lameness. I am not acquainted with any author who has described the disease or the remedy;* I shall therefore give, such a description as my experience has furnished me with, and such as will suffice to distinguish a complaint, which, when recent, admits of an easy method of cure.

"This disorder may happen with or without contusion. In the latter case it is readily distinguished. In the former, the symptoms are equivocal, till the effects of the contusion are removed. When no contusion has happened, or the effects of it are removed, the joint, with respect to its shape appears to be uninjured. If there is any difference from its usual appearance, it is, that the ligament of the patella appears rather more relaxed than in the sound limb. The leg is readily bent or extended by the hands of the surgeon, and without pain to the patient: at most the degree of uneasiness caused by this flexion and extension is trifling. But the patient himself cannot freely bend nor perfectly extend the limb in walking; but is compelled to walk with an invariable and small degree of flexion. Though the patient is obliged to keep the leg thus stiff in walking; yet, in setting down, the affected joint will move like the other.

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* I shall presently show that Bromfield was not ignorant of the case.

"The complaint which I have described may be brought on, I apprehend, by any such alteration in the state of the joint, as will prevent the condyles of the os femoris from moving truly in the hollow formed by the semilunar cartilages and articular depressions of the tibia. An unequal tension of the lateral or cross ligaments of the joint, or some slight derangement of the semilunar cartilages, may probably be sufficient to bring on the complaint. When the disorder is the effect of contusion, it is most likely that the lateral ligament on one side of the joint may be rendered somewhat more rigid than usual, and hereby prevent that equable motion of the condyles of the os femoris, which is necessary for walking with firmness."

The mode of cure proposed by Mr. Hey and which he found successful in a variety of cases, consisted in placing his patient upon an elevated seat having nothing underneath it which could prevent the leg from being pushed backwards towards the posterior part of the thigh and then extending the joint by the assistance of one hand placed just above the knee while with the other hand he grasped the leg. During the continuance of the extension he suddenly moved the leg backwards that it might make as acute an angle with the thigh as possible. Immediately after this simple operation his patients were in general able to walk without much inconvenience and the joint soon regained its natural condition. If one trial should fail, a repetition of Mr. Hey's method should be made. I have seen several cases of this accident in which Mr. Hey's plan has been immediately successful, a dancing master among others, was twice affected with this singular and sudden lameness and was very promptly cured by a few extensions and flexions of his limb; he began capering immediately after as if nothing had happened.

Mr. Bromfield appears to have been acquainted with the accident. "I have seen (he remarks,) a temporary lameness happen from one of the semilunar cartilages within the joint of the knee, having slipped out of its situation; the knee immediately became swelled, and very painful. This case I first discovered by accident; for the assistant having hold of the leg, and sometimes lightly extending, at other times gently bending it, while I was examining the joint of the knee the cartilage slipped into its place, and the patient soon became easy.

"I dare say many surgeons have seen a lameness in the shoulder from almost a similar cause, that is, the tendon of the biceps muscle, which runs in the excavated groove at the head of the os brachii, having, by some turn of the limb, slipped out of the sulcus, and resting on one of the little exuberances of the upper part of the channel, till it returned, has occasioned not only an immobility of the joint, but, most violent pain: when the case is known, the reduction is very easy; for, the cubit being bent, the muscle is relaxed and while an assistant holding the lower extremity of the os brachii, moves the head thereof, sometimes inward, sometimes outward in the acetabulum scapula, the operator with his fingers will easily replace it, and the patient presently becomes perfectly easy."*

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* *Chirurgical Observations and Cases.*—Vol. 2.

CHAPTER XLVI.

Dislocations of the bones of the Leg.

"The tibia, at its articulation with the condyles of the femur, may be luxated in four different directions; viz. anteriorly, posteriorly, and laterally to either side of the knee. The luxation backwards is always incomplete; it could not be otherwise without a great laceration of the soft parts. It is as often secondary as primary, and in such cases it is a concomitant of white swelling, a disease much more grievous than the dislocation, and almost always requiring amputation.

"Luxation forwards is still more rare than that backwards; the ligaments of the knee and the greater part of the tendons surrounding it, being placed nearer its posterior than anterior part, prevent the too great extension of the leg. Luxations inwards and outwards are the most frequent. They are always incomplete, on account of the extent of the articulating surfaces, and the strength of the parts surrounding the articulation. They take place from the femur being drawn either inwards or outwards, while the leg is fixed.

"The luxation backwards is distinguished by attending to the following circumstances: it is impossible to extend the leg; the patella, closely applied to the pulley of the femur, forms an eminence, under which there is an empty space, and the inferior ligament is extended obliquely downwards and backwards; and a projection formed by the extremity of the tibia, is felt in the ham, &c. &c.

"Symptoms of an opposite kind accompany the luxation forwards. Those inwards and outwards are easily known from the deformity of the joint. In the first, the external condyle of the femur is lodged in the internal cavity of the tibia, and the internal condyle projects and forms a tumour at the internal side of the knee: the contrary takes place in the second. When they are complete, which is extremely rare, the tibia is carried entirely to the internal or external side of the femur. In every case of luxation the laceration of the ligamentous parts is so great, that the ends of the tibia and femur may be easily placed in their natural situations; there is scarcely occasion for even gentle extension and counter-extension. It happens sometimes, notwithstanding the extent of the articulating surfaces, that a return of the luxation takes place from the great laceration of the parts which should confine the bones. To prevent this, an apparatus similar to that used in fractures of the thigh, is to be applied. Disagreeable symptoms, occasioned by the laceration of the soft parts, are always to be expected; our attention should be particularly directed to moderate and subdue them. The antiphlogistic regimen must be strictly observed, and the other means of preventing and subduing inflammation had recourse to. If the inflammation terminates in suppuration, the abscesses are to be opened by making a large incision. In general, large openings are to be made in abscesses seated in the neighbourhood of joints to allow a free evacuation of the pus, which by stagnating might become acrid, and attack the cartilages of the joint; but if the abscesses be formed in consequence of a caries of the ends of the bones, a very small opening is to be made, in order to prevent as much as possible the inflammation of the joint. If the inflammation terminates in gangrene, we must wait until nature has arrested the progress of the mortification, and then amputate. The separation of the living from the dead part, is marked by an inflamed circle. The progress of the mortification is very often so rapid that it is impossible to save the patient; and perhaps a complete luxation of the tibia from the femur may be considered as a case requiring immediate amputation. However, before a general precept of this kind can be established, it must be founded on observations well made and judiciously compared.

"The fibula is difficultly displaced from the tibia, with which it forms two articulations; nevertheless we may conceive, that in a violent and sudden turn outwards of the foot, if its ligaments are naturally relaxed, it may slide from below upwards, so as to touch the external condyle of the femur. Citizen Boyer has seen a luxation of this kind in consequence of a dislocation of the foot outwards. By putting the foot in its natural direction, the fibula descended into its proper place. Compresses soaked in resolvent liquids were placed over the part, and a roller was passed round the foot and leg, to prevent a return of the luxations. The patient had a tardy recovery, and some stiffness of the foot remained, though the precaution of moving it, when the state of the parts would admit it, was not neglected."

CHAPTER XLVII.

Of Dislocations of the Foot.

"THESE luxations are but seldom met with; the great violence necessary to produce them and the difficulty of effecting them, account for their unfrequency. Before they can take place, the astragalus must be partially or totally forced from the quadrangular cavity formed for it by the two bones of the leg, and in which it is received like a mortise. The sides of the articulation are strengthened by very strong ligaments, which go from the tibia and fibula to the os calcis and astragalus and by the two malleoli. An external violence, it is true, may distend or even break these ligaments; but its force being almost entirely spent in producing this effect, will not be sufficient to force the astragalus from the cavity in which it is enclosed.

"The foot may be luxated inwards or outwards, forwards or backwards, and the luxation in any of these directions may be complete or incomplete. Luxations inwards and outwards are the most frequent; the former, however, occurs more frequently than the latter: the internal malleolus not descending so low as the external, the astragalus has a less space to describe from without inwards, than in the contrary direction. It is occasioned by a violent abduction of the foot, and is easily known from the derangement of this part, the sole of which is turned outwards, and the back inwards; from the pain, and inability of moving the foot; and lastly, by the eminence formed below the internal malleolus by the astragalus.

"In the luxation outwards, it is equally impossible to move the foot; the sole is turned inwards and the back outwards, and the astragalus forms an eminence below the external malleolus.

"Luxations of the foot are always dangerous; their consequences may be so dreadful as to occasion death, and in very many cases they render amputation necessary. However the prognosis is not always so unfavourable, for it is clearly proved, that many patients have recovered without any thing extraordinary having occurred during their treatment. This invalidates the general rule laid down by J. L. Petit to amputate before twenty-four hours after the luxation. It is also now well ascertained that dislocations likely to produce the most mischievous consequences, have had a happy termination, and that this was the case, though the soft parts have been very much injured, the ligaments nearly quite ruptured, and the astragalus completely removed from the foot.

"The reduction should be accomplished as soon as possible in every luxation of the foot; if deferred the inflammatory symptoms and swelling which supervene, will render it difficult and painful. To effect this, one assistant makes counter-extension, by fixing the leg, and another draws the foot, whilst the surgeon pushes the latter part in a direction contrary to that in which it was luxated. If the luxation be inwards, the external edge of the foot must be depressed by elevating the internal, when it is found that the ligaments yield to the extension: the contrary is done in luxations outwards. The articulation is covered with compresses moistened with resolvent liquids; and splints which reach below the sole of the foot, are applied on the inside and outside of the leg.

"Consequences more or less disagreeable are always to be expected, which may be moderated or even prevented by copious and repeated bleedings. Sometimes, notwithstanding the enormous derangement and laceration of the soft parts, no bad symptom succeeds, and the patient recovers with an unexpected rapidity; but in very many cases, violent inflammation supervenes and quickly terminates in gangrene. In other cases the inflammation terminates in suppuration, abscesses form and heal up, and the patient recovers. Sometimes, however, there is a caries of the ends of the bones conjoined with them.

"The experienced practitioner is to judge, from the nature and violence of the symptoms, when immediate amputation is necessary. A great number of observations posterior to those of J. L. Petit, prove that, by following his instructions, we should often amputate a limb which might be preserved. It is also ascertained by experience that the astragalus may be extirpated with advantage, when the laceration is such, that it is only attached by a few shreds of ligament. The tibia, in consequence of this extirpation, descends, and rests upon the superior face of the os calcis, to which it grows, and the patient recovers its use, with an anchylosed joint; but such a termination is preferable to losing the foot by amputation, or running the risk of the dangerous symptoms arising from preserving the astragalus. Ferrand performed this operation on an invalid soldier, who was in the habit of carrying the bone in his pocket. Desault performed it three times with success. One of his three patients (a female) died three months after the operation; but she evidently fell a victim to an hospital fever, which was by no means connected with the complaint for which she was admitted into the hospital. On dissecting the foot, the extremity of the tibia was found already partially attached to the os calcis. There is no doubt but that the operation would have been crowned with complete success, had the person survived the other disease.

"Fracture of the fibula near its inferior extremity, is a frequent complication of luxation of the foot inwards. This bone is to be carefully examined in all such cases, and the foot is to be supported, whether the fibula be fractured or not, by means of the ordinary apparatus for fractures of the leg.

"Luxations forwards and backwards, less frequent than those described, are, however, sometimes met with. The first is occasioned by a fall backwards, while the foot is fixed to the ground; the second by a fall on the feet, with the body inclined forwards, and the leg much bent. The luxation forwards is more difficultly produced than that backwards, on account of the articular pulley of the astragalus which inclines forwards the posterior side, being permitted to slide much on the tibia, without abandoning it in the extension of the foot. When the extension is carried too far, luxation forwards is produced." (BOYER.)

I have known this accident occasioned in the following manner: a lady who wore high heeled shoes, was descending rapidly a flight of stairs, the heel of one of her shoes hooked itself upon a step, and her whole weight was consequently impelled against the anterior part of the ankle joint, the foot being fixed by the shoe to the step, the tibia was forced forwards, ruptured the capsular ligament and was luxated anteriorly.

"In the luxation backwards, the external and posterior ligaments, and the posterior part of the capsule, are torn; in that forward, the anterior and external ligaments, the anterior fibres of the internal lateral ligament, and the anterior part of the capsule are torn. The symptoms of the first species are, a diminution in length in that part of the foot between the lower part of the leg and the anterior extremity of the toes, elongation of the heel, tension of the tendo achilles, and relaxation of the entensors of the toes. It is impossible either to bend or extend the foot: this symptom distinguishes luxation from sprain, in which the foot may be moved, though not without pain, however high the inflammation may be.

"Contrary symptoms accompany the luxation forwards: the foot is lengthened, the heel is shortened, and the foot, much extended, cannot be bent, &c.

"The reduction of both is easily effected; after which it will be necessary to use effectual means to prevent a relapse. The mode of treatment, to be afterwards observed, for subduing the unfavourable symptoms that supervene, is the same as that pointed out for luxations inwards and outwards. When gangrene takes place in any luxation of the foot, we must defer amputation until its ravages are arrested. In cases where the inflammation is moderate, aud the destruction of the soft parts not considerable, the articulation may be preserved; and to prevent stiffness of the joint, the foot is to be moved as soon as circumstances will admit of it.

"The very thick and short ligamentous substance which unites the astragalus to the os calcis, binds them so strongly together, that they follow one another in their motions, and form as it were but one bone. Hence they are never completely separated, even in the most desperate cases of the luxation of the foot; but one or both of them may be luxated from the scaphoides and cuboides. The transverse direction of the articulation formed by these four bones, suggested to Chopart the ingenious idea of amputating only part of the foot. But these luxations, less dangerous than the others, can be occasioned only by a violent effort, in which the anterior part of the foot is fixed, as happened in the two cases related by J. L. Petit: the foot was fastened in an iron grate, whilst the body was drawn backwards. The astragalus and os calcis, may, under these circumstances, be luxated, but particularly the former, the head of which slides from below upwards, in the cavity of the posterior face of the scaphoides, and forms a tumour on the back of the foot. The inflammatory swelling renders it often difficult to ascertain this luxation. It is not easily reduced, even shortly after it has taken place. Citizen Boyer failed in a case of this kind, in which the head of the astragalus was luxated upwards and inwards, by a fall from a horse; but after some time the person felt no inconvenience from the affection, he could walk without pain or lameness, and nothing remained but the deformity occasioned by the tumour.

"The other bones of the tarsus and metatarsus are too strongly tied together to admit of luxation. The phalanges of the toes cannot be luxated by external violence, on account of their shortness. However, the possibility of luxation of the first phalanx of the great toe from the first bone of the metatarsus may be easily conceived. It is not necessary to give here the rules to be followed in such a case. They consist in reducing the luxation, and amputating the great toe, when the state of the soft parts renders it impossible to preserve it." (BOYER.)

CHAPTER XLVIII.

Injuries of the Head.

AMONG the various accidents which call for the surgeon's aid, none are more important than those to which the head is liable; they in many cases, prove very speedily fatal, and always require the greatest attention.

The scalp is liable to wounds and contusions;—wounds of the scalp have been already noticed, but it may be useful to mention on the present occasion, that, in addition to the usual effects of blows in which the scalp is chiefly concerned, a severe pain sometimes remains for a great length of time after the accident.

Dr. Physick describes in his lectures, several cases of this singular affection, in which a great variety of means were employed without any evident advantage, and in which after a lapse of time the pain subsided. In some cases, an incision through the scalp at the injured part proved immediately successful; in others, it was found entirely inefficient. I know of no remedy for this terrible complaint which happily is of rare occurrence, but which in severity and obstinacy, is surpassed by no local pain. Cold-bathing, sea-bathing, mercury, copious bleeding, blisters, issues, purging, emetics, all the narcotics, and numerous other remedies have been used in some instances without any effect. The incision down to the bone should be tried, as it has in some cases produced immediate relief.*

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* I am very happy to add to this edition, that emetics have been tried by Dr. Physick in several cases of this singular malady, with complete success, and in two instances I also have found them successful. A dose of ipecacuanha, or tartar emetic is to be given every day, till three doses are taken, afterwards, once in two or three days, according to the urgency of the case. This practice has also effected the cure of several obstinate cases of an analogous disease, the tic doloreux.

A blow on the scalp sometimes occasions an ecchymosis, in which the blood forming the tumour remains fluid, and the surrounding scalp feels unusually hard and elevated, and conveys to the fingers a sensation resembling that of depressed bone. Mr. Pott has described this accident particularly, with a view to caution young practitioners against opening the tumour under an expectation of finding depressed bone. The proper treatment consists in promoting the absorption of the extravasated blood by cold applications, and if these are unsuccessful a small puncture may be made with a sharp lancet, and the fluid pressed out. If suppuration take place, the abscess must be treated in the usual manner. It is prudent in all injuries of the scalp to enjoin a low diet and prescribe a purge.

The effects of a blow on the head, owe their chief importance to the affections of the brain which result. In describing these, we shall first notice those cases in which the brain is injured by *concussion or contusion;* afterwards, those cases in which it is compressed by extravasated blood or a fragment of bone; and thirdly, proceed to describe the effects of inflammation.

CHAPTER XLIX.

Of Concussion of the Brain.

A PATIENT who receives a violent blow on the head is immediately deprived of sense and voluntary motion—in popular language he is *stunned.* Respiration is performed slowly, and the pulsations of the heart and arteries are diminished in frequency. In a lesser degree the symptoms are stupidity, drowsiness, imperfect articulation in speech, diminution in the vigour of all the animal functions, nausea, and vertigo. The pupil of the eye is generally dilated, at other times contracted, and often not at all changed. These effects result from blows on the head which occasion fractures of the skull; from those in which an extravasation of blood takes place within the cranium,—and also from blows which produce no fracture and no *considerable* extravasation. It is the latter case which is denominated *concussion,* but whether the symptoms enumerated do ever result from accidents which occasion *no extravasation,* no rupture of a blood-vessel, no organic lesion in the contents of the cranium, I very much doubt. Dr. Physick many years ago dissected the brain of a person who died on the fifth day after a concussion; it was found to have suffered a contusion; numerous extravasations of small quantities of blood, were observed throughout the surface of the cortical substance of the brain in the vicinity of the part stricken, and it resembled a bruise, in every respect. Probably the state of the brain after a concussion is always that of a contusion,—numerous blood-vessels of a small size are ruptured, and pour out small quantities of blood in various places.

That we ought to consider concussion as a lesser degree of compression from extravasated blood, in every instance, I am not prepared to assert; but that in all cases of violent concussion this bruised state or *ecchymosis* of the brain does exist, I have no doubt. The doctrine is by no means novel—Le Dran appears to have entertained it to a certain degree, and John Bell also advocates it.

When the brain has suffered concussion merely, the symptoms which have been mentioned gradually subside, the pulse rises to its natural state, the drowsiness wears off, sensation is restored, and the functions of the body are performed as usual.

The immediate effects of concussion being over, the only ill effects to be dreaded are those which arise from inflammation of the brain, and its consequences; and to guard against these is all that is necessary in the treatment of the case. Cloths wet with cold water should be applied to the injured part, and the patient should be kept at rest with his head somewhat elevated, during the continuance of the stupor; after this has gone off, bleeding, purging, and a low diet are to be directed, and should inflammation supervene, these remedies are to be vigorously employed according to the exigency of the case. Nothing I conceive can be more improper than the use of ardent spirits, volatile alkali, and other stimuli which have been recommended in cases of concussion of the brain. The final cause of the languid circulation which succeeds a blow on the head, is probably the prevention of extravasation, and yet the officious surgeon attempts to interrupt it by stimuli, and thus urges on the action of vessels, wounded and bruised by the previous injury which consequently pour out an increased quantity of blood and produce all the ill effects of compression of the brain.

Mr. Abernethy has described with so much accuracy the effects of concussion of the brain, that I shall transcribe his remarks in this place. "The whole train of symptoms following a concussion of the brain, may I think, be properly divided into three stages. The first is that state of insensibility and derangement of the bodily powers, which immediately succeeds the accident. While it lasts the patient scarcely feels any injury that may be inflicted on him. His breathing is difficult, but in general, without stertor; his pulse intermitting, and his extremities cold. But such a state cannot last long; it goes off gradually, and is succeeded by another, which I consider as the second stage of concussion. In this the pulse and respiration become better, and though not regularly performed, are sufficient to maintain life, and to diffuse warmth over the extreme parts of the body. The feeling of the patient is now so far restored, that he is sensible of his skin being pinched; but he lies stupid and inattentive to slight external impressions. As the effects of concussion diminish, he becomes capable of replying to questions put to him in a loud tone of voice, especially when they refer to his chief suffering at the time, as pain in the head, &c. otherwise, he answers incoherently, and as if his attention could not be excited, or was occupied by something else; he is in short like a man in a heavy sleep. The concussion of the brain, lastly, produces a state of inflammation of the organ, and this constitutes the third stage, which is the most important of the series of effects proceeding from this cause.

"These several stages vary considerably in their degree and duration; but more or less of each will be found to take place in every instance where the brain has been violently shaken. Whether they bear any certain proportion to each other or not, I do not know. Indeed this will depend upon such a variety of circumstances in the constitution, injury, and after-treatment, that it must be difficult to determine.

"With regard to the treatment of concussion, it would appear, that in the first stage very little can be done. From a loose, and, I think, a fallacious analogy between the insensibility in fainting, and that which occurs in concussion, the more powerful stimulants, such as wine, brandy, and volatile alkali, are commonly had recourse to, as soon as the patient can be made to swallow. The same reasoning which led to the employment of these remedies in the first stage, in order to recal sensibility, has given a kind of sanction to their repetition in the second, with a view to continue and increase it.

"But here the practice becomes more evidently pernicious. The circumstance of the brain having so far recovered its powers, as to carry on the animal functions in a degree sufficient to maintain life, is surely a strong argument that it will continue to do so, without the aid of such means; which tend to exhaust parts already weakened by the violent action they induce.

"It seems probable that these stimulating liquors will aggravate that inflammation which must ensue sooner or later. The access of it in the cases which I have related, is sufficiently evident; and its cure is to be effected by the common methods. The great benefit of evacuations was, in those cases very evident. Indeed, it appears to me, that there is no complaint which requires such means to be more rigorously prosecuted, than an inflammation of the brain or its membranes.

"In addition to the reasoning which I have offered here, I would observe, that the surgical books abound with cases in which suitable evacuations have been freely employed in concussions, with the best effects; while the advocates for a contrary practice, have rested their arguments upon vague theory, and communicate no particulars of their success." For the cases referred to in the preceding quotation the reader is referred to Mr. Abernethy's book.

CHAPTER L.

Of Compression of the Brain.

Compression of the brain may be produced by blood extravasated within the cranium, or by a portion of the skull being beat in below its natural level.

OF COMPRESSION FROM EFFUSED BLOOD.

Blood may be extravasated between the skull and dura mater;—immediately beneath the dura mater;—beneath the pia mater;—into the ventricles;—or into the substance of the brain. The symptoms in all these cases are similar. It has always been an object of interest among surgeons to designate the symptoms which attend compression of the brain, and to discriminate them from those arising from concussion, and although no subject has been more carefully investigated than this, yet amidst the multiplicity of observations which are to be found in surgical writings, no accurately distinctive symptoms have ever been pointed out, and this furnishes an argument in favour of the opinion that in concussion there is extravasation.* The loss of sense, speech, and voluntary motion, which attends severe concussion, is alike common after extravasations of blood, and depression of the skull. Mr. Abernethy observes on this subject, that "If we judge of the symptoms of compression from what occurs in cases of apoplexy, or from cases of the rupture of the middle artery of the dura mater, we must be of opinion that pressure on the brain occasions insensibility partially, or generally, and in a degree proportionate to its quantity."

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* Le Dran long ago observed, that "in concussion small vessels may be ruptured and thereby occasion extravasations in several places." *Gutaker's translation*—P. 377.

This remark of Mr. Abernethy's is generally, but not universally correct, for as Pott observes "sometimes a very small quantity of extravasated blood will produce the most alarming and most pressing symptoms, and at other times a large quantity will occasion none at all."

"In extreme cases the insensibility is manifested by every circumstance. *The pupil of the eye is dilated and cannot be made to contract, even by a strong light. The respiration is slow and stertorous, and the pulse proportionably slow and labouring. There is no vomiting which would indicate sensibility of stomach. The limbs are relaxed as in a person just dead. No struggles take place, nor signs of sensation appear during the operation, but on the pressure being removed sensation and intelligence are immediately restored.* In CONCUSSION *the insensible state is of short duration* and during its continuance the body is generally cold, and the pulse feeble and intermitting. Afterwards the skin is hotter than usual; the pulse and respiration more frequent, the former often intermits, and the latter has not the stertor of apoplexy (but the absence of stertor must not be relied on as a proof that there is no compression, for Morgagni relates dissections of apoplectic persons where the effusion was considerable, yet no stertor had occurred, and I have seen cases where it took place only in a very slight degree.) The pupil of the eye is not dilated, but rather contracted. The countenance expresses pain and uneasiness, and vomiting occasionally takes place. The state of the patient is like that of a heavy and uncomfortable sleep; yet being roused, signs even of intelligence appear." These remarks of Mr. Abernethy contain the best contrast of the symptoms resulting from concussion and compression which are to be found, but in some cases they are insufficient to afford an accurate diagnosis.

In many instances, however, the symptoms indicating extravasation are very clearly marked; of a great number of cases which I have met with in books and in practice, I shall relate the prominent circumstances of one, to illustrate this observation.

CASE.

On the tenth of May 1811, MICHAEL SCHOCH, aged about forty years, in ascending the first step of a staircase fell backwards on the floor; he arose, rubbed his head, and did not suppose himself much hurt. About twenty minutes after the accident, he felt sick at the stomach and vomited. In half an hour he became drowsy and stupid, his stupor gradually increased, and when I saw him, which was several hours after the accident, he was perfectly senseless and could not be roused. His breathing was stertorous, his pulse about forty, and communicated to the fingers the same sensation, as that of a patient in apoplexy.

Upon shaving the head, not the slightest vestige of injury could be observed. From these circumstances it was very obvious that a blood-vessel was ruptured within the cranium. His brother said that he had pointed to the left side of his head above the ear, after his fall; and with no other direction than this, as to the part injured, I resolved to perforate the parietal bone, and accordingly cut through the scalp and applied the trephine; immediately on removing the bone a large quantity of blood escaped at the opening, and upon passing my finger under the cranium, I was literally unable to feel the dura mater; clots of blood appeared to occupy the place of the whole left hemisphere of the brain, the quantity of blood extravasated was very great; far exceeding any thing I had conceived possible.

Copious extravasations always happen when one of the principal vessels of the dura mater is ruptured, but when this membrane is merely separated from the skull by the accident, and the only vessels divided, are those which connect the bone and membrane, then the quantity effused is comparatively small supposing the middle artery of the dura mater to be opened in the present instance.

I determined to make another perforation with the trephine, and then trust the case to copious bleeding and purges. I accordingly enlarged the incision of the scalp, and now discovered a small fissure an inch long in the parietal bone, (which probably was in itself of no importance) without any depression; the greater part of this crack was included in the second portion of bone which I removed. In a few hours the stupor subsided and the pulse rose. The patient was copiously and repeatedly bled, and for three weeks nourished exclusively by toast and water; the blood for the first week came away in large quantities through the openings in the skull, and afterwards blood and matter came out together. This patient soon recovered and has remained perfectly well for two years, except that he is afflicted with a periodical head-ach with which for many years he has been troubled, and which has recurred since the accident. His right side was slightly paralytic for a day or two after the operation, but no permanent affection of that nature remained. Mr. Hill relates a case very similar to this, and Mr. Latta also records one not unlike it.

In the preceding case, as in many other instances of extravasation, the patient remained well for a considerable space of time; this was owing to the gradual accumulation of the blood which did not immediately collect in sufficient quantity to occasion stupor. Patients often walk to a considerable distance before any symptoms of compression appear. In every case, therefore, when after the blow, the patient remains a considerable time free from stupor, we may conclude without much risk of mistake that extravasation has happened, or if the patient be stunned by the blow and recover from this first effect of the violence, and regain his senses, and after this interval of sense, relapse into a stupid comatose state; we have also great reason to apprehend extravasation.

It has already been observed that the situation of the effused blood varies. In general, however, indeed in a very large majority of instances, the extravasated blood is found between the dura mater and the skull; owing to the intimate connection by means of vessels between this membrane and the bone. In every case, therefore, where there is good reason to believe that extravasated blood exists under the skull, it is the duty of the surgeon to remove a portion of the bone in order to allow its escape.

In endeavouring to ascertain the part of the head where this extravasation will probably be found, all the circumstances of the accident are to be carefully considered. The head being shaved, a bruise or wound may generally be discovered at the injured part, and if so, the crown of the trephine should be applied at that part. If, however, (as sometimes happens) no part of the head appears to have suffered more than another and the witnesses of the accident can give no account of the spot which received the blow, still should the symptoms continue to indicate the operation, it ought to be performed, and the part where extravasations most generally happen, should be selected; perforations may in such cases with great propriety be made in the course of the middle artery of the dura mater, and if the extravasation be not found here the operation should be repeated on the opposite side of the head, over the same vessel. If paralysis of one side of the body exist, it affords a presumption that the opposite side of the head has suffered.

In attempting to ascertain the place of extravasation, Mr. Abernethy recommends to scrape the bone where the mischief is suspected, if it bleed, there will be no reason to expect an effusion under it, if no blood escape from the bone when scraped, it is an evidence of extravasation underneath. This truly ingenious idea was suggested to Mr. Abernethy, in reflecting on the vascular connection subsisting between the dura mater and skull; a great part of the blood of the skull is derived from the dura mater, and if the connection be destroyed, there is a deficiency in the quantity of blood which the bone receives. Mr. Abernethy has in two instances by attending to this rule, ascertained the extent to which the dura mater and skull were separated by extravasation.*

On removing a portion of bone the blood if fluid immediately escapes; in most instances, however, a considerable portion of it will be found coagulated. The dura mater being separated from the cranium to an extent proportioned to the quantity effused, the coagula if it can readily be done should be removed, but care should be taken not to injure the dura mater by introducing any instruments for the purpose, it is safer to trust to the action of the brain, which will effectually expel these coagula. In cases where the quantity of blood found under the cranium is very great, two perforations may be made, or perhaps cases may occur where a greater number will be necessary, but from what I have seen of such cases, and from similar ones contained in the memoirs of the French academy, I am disposed to believe that an extensive removal of bone in cases of extravasation is improper, the brain does not immediately react, and the patient expires in some instances before the operation is concluded. The case I have detailed in the present chapter, is a convincing proof of the power of the brain to evacuate the clotted blood even when it exists in the largest quantities.

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* I have myself been less fortunate, and Dr. Parrish has recently put the matter fairly to the test in a case of very copious extravasation. In this instance the parietal bone was detached from all its membranous connexions to a considerable distance, and yet bled freely when scraped.

In some instances when a portion of the bone is removed by the trephine, the dura mater is protruded up into the orifice forming an elevated tumour evidently containing blood; in these cases it has been recommended to puncture the membrane and evacuate the fluid. Of the propriety of this practice I have great doubts. Dr. Physick has witnessed the operation in several cases, all of which terminated fatally, and Mr. Abernethy states that in those cases which he has seen "where blood was extravasated between the dura and pia mater and a division of the former membrane was made for its discharge, in some instances the serous part only could be evacuated; for the coagulum was spread over the hemisphere of the brain, and had descended as low as possible towards its inferior part; in others, though a portion of the effused blood was discharged in a fluid or grumous state, a considerable quantity which was coagulated remained behind, so that very little relief was obtained by the operation. It seems then, that extravasation between the dura mater and the cranium is almost the only case of extravasion which admits of being remedied by the use of the trephine."

Cases have occurred, and some such are recorded, where punctures through the dura mater have been made for the evacuation of blood, and a favourable termination has resulted; these cases are, however, extremely rare, and a fatal event in most instances results. The recoveries which happen after wounds of the dura mater, are by no means analogous; because, in these the membrane is not detached from its usual connexions, and is uninjured except at the wounded part; whereas in cases where it is punctured for the purpose of evacuating either extravasated blood or pus, it is separated from every attachment to the skull and pia mater to a very considerable extent; under such circumstances it generally sloughs, and when this happens, the brain beneath inflames and suppurates, and death is the consequence. I believe the best general practice in cases of extravasation beneath the dura mater, whether immediately under it, or in the ventricles, or in the substance of the brain, will be to bleed copiously and as often as the patient's strength can permit. To administer purges daily, to prohibit all nourishment except bread and water, and to apply blisters over the head.

Under this mode of treatment, I have witnessed recoveries where there was every reason to believe that considerable effusions of blood existed under the dura mater, and I have never seen success attend any other method, though I have full confidence in the testimony of others who have been more fortunate. Mr. Abernethy for instance, relates a case in which one of his pupils evacuated five ounces of blood through a puncture in the dura mater and cured the patient.—Here the case was recent, the blood was still flowing from the wounded vessel, and all the circumstances of the case were as favourable as possible, and under such circumstances the operation may be, and ought to be performed: that is to say, *the dura mater, should be punctured whenever fluid, fresh blood, pushes it out, so as to form a tumour in the aperture made by the trephine, provided the symptoms are also indicative of pressure on the brain to a great degree.*

OF COMPRESSION OF THE BRAIN FROM DEPRESSED BONE.

Fractures of the skull as they are produced in a variety of ways, must differ very materially in their nature and extent. The numerous divisions of the ancients, founded upon these circumstances are, however, of little importance. The chief differences now regarded, are the degree of pressure and irritation produced upon the brain and its membranes.

Fissures or cracks in the skull unattended by a depression of one of the fragments are not dangerous, and very readily heal without unpleasant symptoms; but pressure from a piece of bone beat down upon the brain must occasion all the symptoms which are produced by pressure from an effused fluid: accordingly we find that patients thus circumstanced are generally affected with the same apoplectic symptoms,—a complete or partial loss of sense, speech, and voluntary motion—stertorous breathing, followed by vomiting, vertigo, hemorrhage from the ears, nose, mouth, &c. Now these symptoms often occur without a fractured skull, as has already been remarked, and on the other hand, many cases of fractured skull, even where the bone is considerably depressed, are unaccompanied by them. I once saw a woman who had been assaulted by a lunatic, and struck forcibly with an iron bar: I found her skull fractured near the junction of the parietal bones, a depression existed which in one part was full half an inch below the natural level, and yet none of the usual symptoms of compressed brain occurred, and the fracture healed up without any dressings except a superficial pledgit. Similar cases are recorded.

Fractures of the skull although they occasionally produce no unpleasant symptoms, are notwithstanding, accompanied with many dangers. In addition to the evils to be dreaded from pressure upon the brain, the irritation occasioned by the mechanical action of the sharp and irregular edges of the bone upon the dura mater and brain is to be feared. The constant pulsation of the vessels of the brain, which produces motion under the fracture, augment considerably the irritation in consequence of which the dura mater sometimes ulcerates.

In many cases of fracture of the skull the dura mater is pierced and the brain wounded, by the body which caused the accident, or by a fragment of the bone being forced through these parts. In some instances portions of the substance of the brain escapes through the fracture at the time of the accident. In sabre wounds, slices of brain, together with considerable portions of skull are sometimes removed.

To ascertain the existence of a fracture of the skull, the bone must be laid bare and examined. In general, the part which received the blow is fractured, but sometimes the skull suffers in a remote situation, in consequence of what the French surgeons have called a contre-coup; very good proof exists that fractures have been thus occasioned by counter-strokes, on the opposite side of the skull. If a wound of the teguments accompanies the accident, the fracture is often obvious on the first examination. If the wound be too small to afford a view of the skull, or if only a contusion exist, it is easy with a scalpel to cut down to the bone and expose it sufficiently. This, however, should never be done unless symptoms of compressed brain exist, because the exposure converts the injury to a compound fracture, and greater inflammation is therefore to be expected, from which possibly the dura mater and brain may suffer.

Respecting the treatment of fractured skull, a variety of opinions exist among surgeons. The practice I would recommend I shall briefly state. In every instance where symptoms of compression exist, whether these arise from fracture or from extravasated fluids a perforation ought to be made through the skull by means of a trephine, at the spot where such pressure is reasonably judged to exist. The immediate effects of concussion of the brain, generally subside in a few hours, and as these may be supposed to exist in all cases of injured brain, it will (except in *particular instances* presently to be noticed) be proper to defer the operation, until such effects shall have subsided. If then it be found after waiting twelve hours,* that evident symptoms of compression exist without abatement, the operation should be no longer delayed, but the fracture sought for, and if depressed bone be found it should be elevated, and all loose fragments removed. If a crack or fissure only be found, still the symptoms existing, a perforation should be made to discharge the blood which is probably effused under it.

The *particular cases* in which the operation should be promptly performed, are those in which the extent of injury leaves no doubt as to the existence of fracture with depression, and where there can be no probable expectation that the symptoms will subside when the immediate effects of concussion are over. A man is thrown from his horse head foremost upon a stump or on a stone, and the surgeon on his arrival finds an extensive fracture, with depression, and all the symptoms of compressed brain—in such a case it is right to perform the operation immediately.

Should depressed bone be removed, or the operation of trephining ever be performed to prevent the ill consequences of inflammation of the brain? Mr. Pott under particular circumstances, recommended the practice,—Mr. Abernethy, however opposes it, and Mr. John Bell, Desault, and many modern surgeons, deny that it is ever proper, and assert that the trephine is only to be applied with a view of relieving present symptoms. I have never seen reason to differ from this opinion, and though cases may be imagined where the trephine would *certainly* prevent fatal consequences, yet in practice, such certainty is seldom evident. It would be improper in a compendious work like the present to enter into any discussion on this question: I shall therefore conclude this part of the subject by recommending to postpone the operation of trephining in all cases where doubt exists as to its propriety, because in many cases it will be found, that when inflammation moderates, the symptoms of compression will be diminished by the diminution of fullness in the vessels, and if the operation be indicated afterwards it can still be performed, and perhaps with as good a prospect of success.

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* This is a very general direction, and of course many exceptions will be made to it, as the effects of concussion subside in some cases much sooner than in others,—whenever a doubt exists, postponement is the preferable plan. Mr. Abernethy and Mr. John Bell, both sanction this practice.

OF INFLAMMATION OF THE BRAIN AND ITS MEMBRANES FROM EXTERNAL VIOLENCE.

Mr. Abernethy very judiciously remarks, that "in the generality of cases of injury done to the head, the symptoms of *concussion*, *compression*, and *inflammation*, are so combined as to appear inexplicable. It is only by an attention to those rare cases, in which the symptoms of each appear distinctly, that we are likely to increase our knowledge of their specific effects." Inflammation of the brain and its membranes is a consequence of different species of violence to which it is subject, and therefore, its symptoms will be more or less blended with those resulting directly from the accident, as stupor, &c. In describing the inflammatory symptoms which occur, I shall principally avail myself of the descriptions given by Mr. Pott and Mr. Abernethy. The INFLAMMATION OF THE DURA MATER is well described by the first of these writers.

"If there be neither fissure nor fracture of the skull, nor extravasation, nor commotion underneath it, and the scalp be neither considerably bruised, nor wounded, the mischief is seldom discovered or attended to for some few days. The first attack is generally pain in the part which received the blow. This pain, though beginning in that point, is soon extended all over the head, and is attended with a langour, or dejection of strength and spirits, which are soon followed by a nausea and inclination to vomit, a vertigo, or giddiness, a quick and hard pulse, and an incapacity of sleeping, at least quietly. A day or two after this attack, if no means preventative of inflammation are used, the part stricken generally swells, and becomes puffy and tender, but not painful; neither does the tumour rise to any considerable height, or spread to any great extent: if this humid part of the scalp be now divided, the pericranium will be found of a darkish hue, and either quite detached, or very easily separable from the skull, between which and it, will be found a small quantity of a dark-coloured ichor.

"If the disorder has made such progress; that the pericranium is quite separated and detached from the skull, the latter will even now be found to be somewhat altered in colour from a sound healthy bone. Of this alteration it is not easy to convey an idea by words, but it is a very visible one, and what some very able writers have noticed.

"From this time the symptoms generally advance more hastily and more apparently; the fever increases, the skin becomes hotter, the pulse quicker and harder, the sleep more disturbed, the anxiety and restlessness more fatiguing, and to these are generally added irregular rigors, which are not followed by any critical sweat, and which instead of relieving the patient, add considerably to his suffering. If the scalp has not been divided or removed, until the symptoms are thus far advanced, the alteration of the colour of the bone will be found to be more remarkable; it will be found to be whiter and more dry than a healthy one, or, as Fallopius has very justly observed, it will be found to be more like a dead bone: the sanies or fluid, between it and the pericranium, will also, in this state, be found to be more in quantity, and the said membrane will have a more livid diseased aspect.

"In this state of matters, if the dura mater be denuded, it will be found to be detached from the inside of the cranium, to have lost its bright silver hue, and to be, as it were, smeared over with a kind of mucus, or with matter, but not with blood. Every hour after this period, all the symptoms are exasperated and advance with hasty strides: the head-ache and thirst become intense, the strength decreases, the sighs are more frequent, and at last convulsive motions, attended in some with delirium, in others with paralysis or comatose stupidity, finish the tragedy.

"If the scalp has not been divided or removed till this point of time, and it be done now, a very offensive discoloured kind of fluid, will be found lying on the bare cranium, whose appearance will be still more unlike to the healthy natural one; if the bone be now perforated, matter will be found between it and the dura mater, generally in considerable quantity, but different in different cases and circumstances. Sometimes it will be in great abundance, and diffused over a very large part of the membrane; and sometimes the quantity will be less, and consequently the space which it occupies smaller. Sometimes it lies only on the exterior surface of the dura mater; and sometimes it is between it and the pia mater, or also even on the surface of the brain or within the substance of it.

"The primary and original cause of all this, is the stroke upon the skull; by this the vessels which should carry on the circulation between the scalp, pericranium, skull, and meninges, are injured, and no means being used to prevent the impending mischief, or such as have been made use of, proving ineffectual, the necessary and mutual communication between all these parts ceases, the pericranium is detached from the skull, by means of a sanies discharged from the ruptured vessels, the bone being deprived of its due nourishment and circulation, loses its healthy appearance, the dura mater (its attaching vessels being destroyed or rendered unfit for their office) separates from the inside of the cranium, inflames and suppurates.

"Whoever will attend to the appearances, which the parts concerned make in every stage of the disease, to the nature of the symptoms, the time of their access, their progress, and most frequent event, will find them all easily and fairly deducible from the one cause, which has just been assigned, viz. the contusion. As the inflammation and separation of the dura mater, is not an *immediate* consequence of the violence, so neither are the symptoms immediate, seldom until some days have passed; the fever at first is slight, but increases gradually; as the membrane becomes more and more diseased, all the febrile symptoms are heightened; the formation of matter occasions rigors, frequent and irregular, until such a quantity is collected, as brings on delirium, spasm, and death.

"Hitherto I have considered this disease, as unaccompanied by any other, not even by any external mark of injury, except perhaps a trifling bruise on the scalp; let us now suppose the scalp to be wounded at the time of the accident, by whatever gave the contusion; or let us suppose, that the immediate symptoms having been alarming, a part of the scalp had been removed, in order to examine the skull; in short, let the injury be considered as joined with a wounded scalp.

"In this case, the wound will for some little time have the same appearance, as a mere simple wound of this part unattended with other mischief, would have; it will like that, at first discharge a thin sanies or gleet, and then begin to suppurate; it will digest, begin to incarn, and look perfectly well; but, after a few days, all these favourable appearances will vanish; the sore will lose its florid complexion, and granulated surface; will become pale, glassy, and flabby; instead of good matter, it will discharge only a thin discoloured sanies; the lint with which it is dressed instead of coming off easily (as in a kindly suppurating sore) will stick to all parts of it; and the pericranium instead of adhering firmly to the bone, will separate from it, all round, to some distance from the edges.

"The first appearance of alteration in the wound immediately succeeds the febrile attack, and as the febrile symptoms increase, the sore becomes worse and worse, that is, degenerates more and more from a healthy, kindly aspect.

"Through the whole time, from the first attack of the fever, to the last and fatal period, an attentive observer will remark the gradual alteration of the colour of the bone, if it be bare. At first it will be found to be whiter, and more dry, than the natural one; and as the symptoms increase, and either matter is collected, or the dura mater becomes sloughy, the bone inclines more and more to a kind of purulent hue, or whitish yellow; and it may also be worth while to remark, that if the blow was on or very near to a suture, and the subject young, the said suture will often separate in such a manner as to let through it a loose, painful, ill-natured fungus; at which time also it is no uncommon thing for the patient's head and face to be attacked with an erysipelas." (POTT.)

The PIA MATER is often attacked with inflammation in consequence of blows on the head. The free communication by vessels between this membrane and the brain, necessarily occasions an extension of the inflammatory action to the substance of the cerebrum. The degree of inflammation of the brain varies, in proportion to the affection of the pia mater. It differs also in the extent of the inflamed surface, and in the depth to which it proceeds; these circumstances occasion a difference in the degree to which the functions are interrupted.

Sometimes the inflammation of the brain is attended with a copious secretion of fluid, and at others a small quantity only is poured out, of course a difference in the subsequent symptoms of compression from this cause will ensue.

Mr. Abernethy remarks "If the inflammation be violent and general, the patient will be irrational and disturbed, having his mind strongly affected by wrong ideas and endeavouring to act in consequence of them. If the inflammation be moderate and affect the surface only, he will be irrational, uneasy, restless, and perhaps endeavour to get out of bed, but without the violence of mania. Should a moderate inflammation be blended with the effects of concussion, he will have less appearance of irrationality, will lie pretty quiet, and inattentive to slight impressions." Some variety will occur probably in the symptoms in different patients, "but in all there will be more or less derangement of the powers both mental and corporeal depending upon the degree of inflammation, &c. The symptoms which chiefly characterize the complaint, are those of an increase of sensibility; the pupils of the eyes are contracted; the patient often withdraws his arm on being touched, and his pulse and tongue denote general, as well as local inflammation. It seems of the utmost importance that those means which in general cure inflammation should be prosecuted very vigorously at the commencement of this complaint, since otherwise although they will check they will not overcome it. Large blood-lettings, brisk purging, and extensive counter-irritation by blisters, ought to be employed at the very commencement, for if omitted, the disease will then become established, and the powers of the body will soon be too much sunk to admit of the same active treatment at a later period."

Suppuration takes place when the remedies are unsuccessful in arresting the progress of the inflammation, and when this happens the symptoms of compressed brain are repeated and a deep coma comes on.

The pus in this case is very often situated directly under the skull, but sometimes under the dura mater, and at other times an abscess is found in the brain. The trephine can only be used with success when the matter can be evacuated, but where the symptoms denote that pus has been actually secreted, a perforation through the bone at the injured part should be made, and the usual means for ascertaining this part, are to be employed. Mr. Abernethy's test of scraping the bone, will probably be found useful in this instance, as well as in cases where the pressure is caused by extravasated blood. When the perforation has been made, if the pus exist under the skull it will flow out, if under the dura mater this membrane should be punctured with a sharp lancet, though recoveries under such circumstances are not to be expected.

Although inflammation of the brain generally occurs within a few days after the accident which causes it, yet in some cases months elapse before its commencement. I assisted Dr. Physick to trepan a gentleman, whose dura mater we found thickened and in a state of suppuration, one year after the occurrence of the accident which occasioned the formation of the abscess.

THE OPERATION OF TREPANNING OR TREPHINING.

The manner of removing portions of the cranium, when this becomes necessary is next to be described. The various obsolete instruments of the ancients, and many of the useless contrivances of modern surgeons may be dispensed with in proceeding to this operation, for as Mr. Pott remarks, "Reduction of the number of instruments to be used in an operation, and an extreme simplicity and plainness in those which may be required, are a part of the merit of modern surgery." The instruments wanted for removing portions of the skull, are a scalpel (with the steel projecting through the handle (Fig. 1.), a trephine with a sliding centre-pin. (Fig. 2.), a saw (commonly called Hey's saw) (Fig. 3.), an elevator (Fig. 4.) a quill tooth-pick, needles, and ligatures. The lenticular, the rhaspatory, the brush, and the other instruments commonly found in the trepanning cases, are quite useless.

The hair being previously removed, an incision is to be made through the scalp down to the bone, and if a longitudinal incision should not sufficiently expose the surface, it may be crossed by another, and extended in any necessary direction. The removal of a portion of scalp as practised by the older surgeons and recommended by Mr. Pott, should never be performed. In making the incision down to the bone, great caution is in some cases necessary to avoid plunging the knife

PLATE XI.

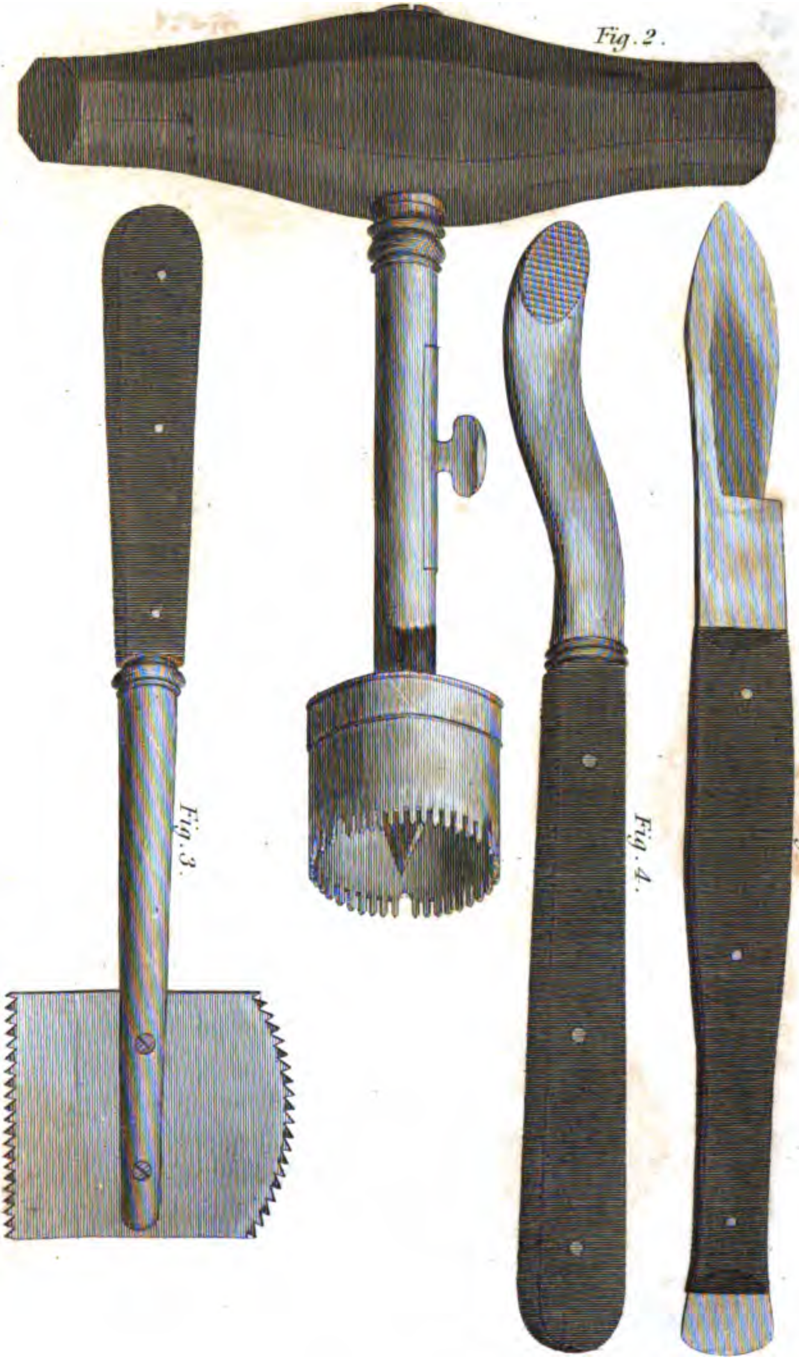

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 1.

through the fracture into the brain. After having denuded the bone of its pericranium, by means of the end of the knife handle, the centre-pin of the trephine is to be protruded, and fixed on the part of the skull which is to be removed. If in a case of fracture, this centre-pin must always be placed upon a piece of firm solid bone, not detached from the skull, and as near as possible to the fracture, and therefore more than half the bone included by the crown of the instrument will generally be uninjured bone. The instrument is to be now freely turned backwards and forwards, by the surgeon, who presses it firmly against the skull, until a groove is formed of sufficient depth to allow the retraction of the centre-pin, which must always be carefully withdrawn as soon as this groove is made, to prevent a wound of the dura mater. The action of the circular saw is to be continued and the depth of the groove very frequently examined. The teeth of the instrument are to be wiped from time to time with a towel, and when they have penetrated to the diploë, less resistance is experienced, and now a great degree of care is necessary on account of the inequalities in the thickness of the inner table of the skull, in consequence of which one part may be completely cut through before the other is nearly divided. The tooth-pick is the most convenient probe for ascertaining the depth of the groove, but when the trephine reaches the tabula vitrea and has made some little impression upon it, it is safer to attempt to break out the circular portion of bone by means of the elevator, than to proceed completely through it with the saw. If any part of the bone is entirely divided and the tooth-pick is found to touch the dura mater, considerable force should be exerted to separate the section of bone without further sawing, as the dangers of a wounded dura mater, are very great; if this, however, be impracticable, the action of the trephine should be directed against the undivided portion of bone exclusively until it is thin enough to be broken off; this can always be done with the common trephine without resorting to the old instrument with a file-like circumference.

If any inequalities of bone remain round the edge of the foramen, they may be broken off by the end of the elevator; the lenticular which has been constructed for this purpose, is by no means a convenient instrument.

When one perforation has been made, in general the depressed bone may be elevated to the proper level, and any loosened portions may be entirely removed. If the operation have been performed in order to evacuate extravasated blood or pus, one opening is generally sufficient, but if necessary the operation may be repeated. The ancient surgeons were in the habit of applying the trepan very frequently, and in some cases very numerous perforations have been made without fatal consequences. In one instance, we are assured that twenty-seven perforations were made through the skull of a nobleman in consequence of a fracture, but no one can doubt that the removal of portions of the skull is a very serious evil, and that it should be performed as rarely as possible.

The introduction of the straight saw into practice has diminished the frequency of using the trephine, and although the instrument is to be found in many old books of surgery, yet until Mr. Hey of Leeds in a publication a few years ago, recommended its use in fractures of the skull, surgeons were ignorant of its great advantages. A variety of cases occur in which it may be substituted for the trephine in removing portions of skull, without the additional loss of bone which the latter instrument occasions.

With respect to the parts of the skull where the trephine may properly be applied, I believe the surgeon hesitates at none, to which he can get access, provided the urgency of the symptoms demand the operation. The sutures offer no barrier and the large blood-vessels none—indeed the basis of the skull is the only part where the operation cannot be performed, and with safety, by a prudent operator. Should the longitudinal sinus or the great arteries of the dura mater be opened either by a fragment of bone, or by the operator, the bleeding is easily arrested by a dossil of lint. I have seen a profuse hemorrhagy from a large opening in the longitudinal sinus occasioned by a fragment of bone, immediately stopped by applying lint over the orifice. The middle artery of the dura mater wounded in the same manner, is as readily secured. Dr. F. Dorsey of Maryland, once tied up this vessel with a needle and ligature, and no ill consequences resulted. In some cases which I have seen this would easily be effected, because the artery could be separated to some distance from the dura mater, with which it is not always intimately connected. I have seen it projecting a quarter of an inch from that membrane in an extensive fracture of the parietal bone, but if the ligature must pass through the dura mater in order to secure it, the operation of tying it up ought never to be performed. If the bleeding from the vessels of the scalp should not spontaneously cease, the needle and ligature are most convenient for securing them.

The only dressing in general required after trephining, is a light poultice of bread and milk; great care should be taken to guard against pressure upon the exposed brain. The remedies proper to prevent and relieve inflammation are always to be employed with great activity. In some cases it may be proper after removing the bone, to place the scalp and dura mater in contact and to allow them to unite, but in a majority of cases this cannot be effected, and when it is attempted great care should be taken to prevent collections of blood and serum or pus from being confined under the scalp, and thus compressing the brain. Where a small wound of the dura mater exists, I believe its adhesion to the scalp at the wound and around it, would greatly diminish the danger of suppuration in the brain.

HERNIA CEREBRI.

When ulceration takes place in the dura mater a tumour generally rises through it, which has been called HERNIA CEREBRI, this tumour in all the cases I have seen, consisted evidently of the substance of the brain, and under the pia mater in several places clots of blood of a dark colour were observed.

These tumours sometimes acquire a large size, and if removed, speedily return. Mr. Abernethy has described some cases which have led him to an opinion that "the disease frequently described by the term hernia cerebri, consists of a tumour formed by coagulated blood; for an organized fungus could hardly be produced in so short a time as that in which these tumours are usually formed." I have no doubt that the tumour consists *partly* of coagulated blood, but *chiefly* of the substance of the brain, which is pressed out at the aperture through the dura mater, in consequence of an abscess having formed in the brain, or immediately under the skull, and in consequence of the increased volume of the brain *which is greatly swelled* by inflammation.

Mr. Abernethy is of opinion that extravasated blood pushes out the brain, and that what would be apoplexy, if the cranium were entire, becomes fungus cerebri, in consequence of the deficiency of bone which allows the brain and coagulated blood to protrude. This no doubt occasionally happens, but a considerable quantity of pus was found in two cases which I have dissected, and the protrusion appeared to be caused by the pressure of this pus. Mr. Charles Bell supposes that though Mr. Abernethy's account be correct, yet two other kinds of tumour arise from the brain—the one a fungus excrescence from the dura mater, the other a proper organized fungus of the brain.

How far these opinions are correct, I shall not decide, but I shall take a greater liberty with his practice than with his opinions, and condemn without hesitation his proposal to cut off the tumour: this I conceive could not answer any good purpose, and would probably be productive of very copious hemorrhagy, which in the exhausted state of the patient might prove fatal. The best application is a light soft poultice, or a pledgit spread with simple cerate. Should the tumour however acquire a very great size, portions may be separated with the knife, as in some of Mr. Hill's cases. Some rare instances are recorded of recoveries from this dangerous affection, but in general it terminates speedily in death.

Since writing the preceding sentences, I have witnessed in my own practice, the recovery of a patient in whom hernia cerebri occurred. On the 5th of August, 1814, I trepanned a girl, aged between eight and nine years, and removed a large portion of the left parietal bone. She had sustained an extensive fracture and depression of the skull, from falling through a hatchway or trap door in a sugar refinery. She was relieved by the operation, from stupor, convulsions, and the usual symptoms of compressed brain, and continued till the twelfth day free from all bad symptoms: at this period a tumour was perceived protruding through a small ulceration in the dura mater: it gradually enlarged and pulsated strongly. This tumour was unattended by any augmentation of fever or stupor, and slowly increased till the thirty-first day. My next visit was a few days after this, and during my absence (the precise time I could not learn) vomiting occurred, during which a copious flow of blood took place from some ruptured vessels in the tumour. From this time I had the pleasure to find the tumour gradually subsiding; granulations formed, the tumour cicatrized, and afterwards diminished, till it returned to the original level of the skull. The patient has remained quite well for several years, and bone has now formed so as nearly to supply the deficiency occasioned by the original injury.

Dr. Physick, in his lectures, suggests the propriety of puncturing the tumour with a lancet, in order, if an abscess can be found, to evacuate the pus.

I have endeavoured to avoid confusing the preceding condensed history of the affections of the brain from external violence by a detail of opinions, or a quotation of wonderful cases. I may now, however, not improperly remark that although the opinions of our predecessors on the subject, are many of them fanciful and unimportant, yet their histories of cases, merit the greatest attention. One general principle I would inculcate from them, which is, *that injuries of the head apparently trifling should never be neglected*; and on the other hand, *those which appear most dangerous and alarming should never be despaired of*. In proof of this I could select instances of death from a blow which scarcely excited attention, and of recovery where the brain had been shot through by a musket-ball. I have myself seen several skulls in an European collection, in which the bony cicatrices demonstrate that large portions of brain and skull had been cut out, and subsequent cures had been effected.

I shall now proceed to relate a case, which I think illustrates more of the usual circumstances of injury of the brain than any other I have met with.

CASE.

P. Welch, aged about twenty-four years, received at midnight, June fifteenth, a violent blow from a brick-bat. He instantly fell, and was conveyed home stunned and scarcely breathing; a quack in the neighbourhood was sent for and by the time of his arrival the symptoms of *the first stage of concussion* had subsided, and the patient's breathing was much improved, his pulse rose, he remained stupid, but moved occasionally, and when his head was touched appeared to suffer pain and put up his hands, as patients generally do in *the second stage of concussion.* He remained in this situation till the afternoon of the succeeding day, the doctor having declared that the skull was not fractured and that he would soon be well. His friends becoming uneasy at the continuance of the stupor had him bled, and sent for surgical aid. I made my visit about twenty hours after the accident, and found him snoring, but if spoken to in a loud tone of voice, he attempted to answer, but could not articulate distinctly. His pulse was full and slow. Over the left ear was a contusion and a small wound which when touched occasioned pain, and the patient moved his head and hands to escape from the examination of it. I made an incision down to the bone and discovered that a portion of the squamous plate of the temporal bone was fractured and depressed. During this operation it was with extreme difficulty that the patient could be kept in bed; he screamed, and moved about violently. Under these circumstances I postponed operating and drew from the arm eighteen ounces of blood in addition to several ounces which had flowed from the branches of the temporal artery.

The next morning, (June seventeenth) no favourable change having taken place but on the contrary the stupor being increased, I proceeded to remove the depressed bone to which the trephine was applied twice, and all the depressed bone as large as a half dollar taken away, a crack extended forwards toward the parietal bone the extent of which appeared considerable, but no cause for tracing it further existed. A little extravasated blood was found under the skull. After the operation the pulse rose and in the evening ʒxvi of blood were drawn from his arm after which he appeared more sensible.

On the eighteenth, the day after that on which the operation had been performed he was evidently better, was perfectly rational though still somewhat drowsy, had no recollection of the accident—was bled ʒxii in the morning and ʒviii in the evening, drank toast and water.

For several days no particular alteration was observed, the wound appeared sloughy, and a portion of the temporal muscle which had been cut through sloughed off. He vomited occasionally and was bled pretty regularly twice a day till the twenty-third. A tumour covered by the dura mater gradually protruded at the wound; this membrane was tense and appeared evidently to contain a fluid. His stupor was increased.

On the twenty-fifth, ten days after the accident, the nurse informed me he was greatly better and was more rational. I immediately suspected that the dura mater had given way and that pus had been evacuated; upon inspecting the head this was found to be the case—a large quantity of pus had been discharged during the preceding night and a hole was observed in the dura mater through which it had issued. I anticipated now the formation of a hernia cerebri, which accordingly happened: on the twenty-seventh (twelve days after the accident) a tumour began to appear protruding through the aperture in the dura mater which gradually increased to the size of a hen's egg and was evidently covered in some parts by the pia mater, and in others had ruptured this membrane and appeared to consist of brain and clotted blood. During the formation of this tumour, and the discharge of matter which attended it, *the patient regained the entire use of his mental faculties,* and appeared to his friends to be getting well; I assured them that these hopes were delusive and that he would not survive many days. He complained of hunger, and his pulse being languid, he was allowed chicken broth, and a few oysters.

On the first of July he had a violent chill, a slough came away from the dura mater, and the tumour of the brain enlarged very considerably;—On the second, copious hemorrhage from the tumour;—On the third at midnight eighteen days after the accident he expired, much blood having been previously discharged from the tumour.

On dissection, the crack noticed during the operation was traced, and I found it to extend completely round the head, having passed through the temporal bone, a small part of the parietal, and separating the os frontis into two portions, by a crack situated immediately above the frontal sinuses parallel to the superciliary ridges. Where the fungous tumour had existed clots of blood only were seen, and on removing these a considerable hole was found in the brain, occasioned by a loss of its substance, the brain to some distance round this vacuity was intermixed with coagula, and completely disorganized, a layer of pus, thick and viscid, intervened every where between the dura and pia mater, and at one place under the fissure in the bone, an extravasation of one half an ounce of blood was found.

In this case the effects of *concussion* were very evident, afterwards those of *compression*, then the usual effects of *inflammation* (not so distinctly marked as in some cases, because compression still existed) followed by *suppuration* and by *hernia cerebri*.

In consequence of gun-shot wounds and other contusions of the skull, exfoliations occasionally happen, sometimes of one and sometimes of both tables of the skull. When the external table is killed, and exfoliation commences, the inner table inflames, and the action of the absorbents as described formerly, removes the earthy matter of the bone, granulations shoot out from the inner table and push off the scale of dead bone, after which, these granulations probably secrete and deposit osseous matter and are converted into solid bone. This process goes on more rapidly in young than in old subjects. In some cases it is performed very slowly in consequence of the granulations shooting up into cavities in the dead bone, and thus connected they prevent for some time the separation; where the delay is evidently owing to this cause some force may be used in removing the dead bone. If both tables of the skull are killed as in cases of gun-shot wounds, the symptoms generally call for the trephine, but if this be not applied, the separation of the dead bone is effected in the usual manner, and granulations arise from the dura mater and fill up the space. The deficiency of bone after portions of the skull have been removed, is supplied by granulations from the surrounding bone and from the dura mater. The bone forms first in contact with the remaining solid bone, and a thin plate afterwards, extends gradually over the aperture. Previously to the formation of this plate of bone, the brain is defended only by a soft cicatrix of skin under which it may be observed pulsating. From this exposed state it is proper to defend it, especially when large portions of skull are deficient by means of firm plates of tin, silver, or leather, which may be worn under a wig, or cap, until the bone is replaced.

CHAPTER LI.

Diseases of the Eye and its Appendages.

HAVING treated of the most usual accidental injuries to which the body is exposed and of the remedies to be employed, we pass on to describe certain morbid affections submitted to the care of the surgeon.

The term disease does not convey a precise and accurate notion of many of these affections; in a qualified sense, however, it may be retained and cannot mislead, when the nature of the various cases is understood.

Inflammation attacks the eye and its appendages as well as the other parts of the body; it may be excited by accidental irritations, or by diseases of the constitution. In some cases it makes its approach without any obvious remote cause.

Inflammation of the *eye-lids* occasions some pain, but less than when the eye-ball is affected—the lids swell in consequence of an effusion of serum into the cellular texture—the skin becomes red and a burning sensation is felt. In some instances, this inflammatory tumefaction of the eye-lid comes on at night, and as only one eye-lid is generally affected the patient ascribes it to the bite of an insect; the cause is not always easily ascertained.

If fever accompany it, as is sometimes the case, the patient should lose blood from the arm, if not, a brisk mercurial cathartic and low diet will generally remove the affection very promptly. A lotion of brandy, or camphorated spirit is often found useful. Should it resist these remedies, repeated blood-letting, the application of a dozen leeches, and the usual antiphlogistic measures are to be employed.

A discharge of pus from the edges of the eye-lids, called PSOROPHTHALMY often calls for the aid of the surgeon. The patient waking in the morning finds his eye-lids closed by a secretion of pus which has dried and keeps them in contact. The glands of Meibomius are generally considered as the seat of this affection. Dr. Physick has been led to believe from his own observations, that the inflammation is seated at the roots of the eye-lashes. The affection of the head called tœnia capitis is probably of the same nature, ulceration existing in both cases at the roots of the hair. One proof of the correctness of this opinion is, that the hair being pulled out the inflammation often gets well, and another, that the tar ointment and spermaceti oil, remedies very successful in tœnia capitis, are advantageous in the present case.

The edges of the eye-lids are sometimes ulcerated in this complaint. The most successful application is the citrin ointment, applied to the part; a solution of lunar caustic has also been used with great benefit. Common mercurial ointment is sometimes successful. Lamp oil, and tar ointment I have several times used with advantage. When the inflammation is very great, leeches should be applied, and purges administered.

A chronic inflammation of the eye-lids called LIPPITUDO sometimes proves extremely obstinate; the patient's eye appears surrounded with a red circle, and the lids are agglutinated in the morning. The treatment recommended in the last case is sometimes successful in this; but in many cases it is extremely obstinate and requires great attention to diet and regimen. I have known instances where it has lasted through life, and has appeared in several members of the same family.

The eye-lids are subject to an inflammatory tumour called HORDEOLUM or stye. It resembles at first a small pimple situated on the edge of the eye-lid, which augments, becomes painful and suppurates. It is in fact a small boil, or phlegmonous tumour, and in general gets well without any surgical aid, occasionally an induration remains after the inflammatory tumour has subsided. If this become troublesome it may be destroyed by lunar caustic.

The eye-lids are subject to two very opposite affections which become sources of great trouble and inconvenience, the one an eversion of the lid, called *Ectropium*, the other an inversion called *Entropium*, or Trichiasis.

ECTROPIUM.

The eversion of the eye-lid most frequently occurs in the lower lid, which is turned outwards towards the cheek and does not come into contact with the eye. Inflammation results from the exposure of the eye, and from the unnatural situation of the puncta lachrymalia, the tears cannot pass through them and of course overflow the cheeks and a very unpleasant tumour of a red, fungous appearance forms in consequence of the distension of the vessels of the conjunctiva. The complaint is occasioned sometimes by the contraction of granulations in the healing of burns, wounds, or ulcers, on the cheek, but oftener from a relaxation and elongation of the eye-lid. The only remedy hitherto relied on, is the removal of the everted lining membrane of the eye-lid, which becomes indurated and enlarged; when this is done by a scalpel or scissars, the lid should be supported in its natural situation by a compress carefully applied, and the wound in healing generally contracts sufficiently to counteract the disease.

A more ingenious operation, however, is described by Sir William Adams in a work published in 1812, at London for the cure of this affection, it consists in cutting out a portion of the lower eye-lid resembling the letter V—the piece thus removed is one-third of an inch wide at its upper part, the sides of the wound are approximated by a stitch, and the diseased conjunctiva cut off—this effects invariably a complete and speedy cure.

ENTROPIUM.

In the ENTROPIUM OR TRICHIASIS, the eye-lid is inverted upon the eye, in consequence of which, the cilia irritate excessively the surface of the eye, and keep up a constant and violent inflammation. According to Scarpa and other writers, two species of this disease are met with; in one the cilia are turned inwards without the tarsus having changed its natural position and direction, in the other the tarsus is inverted, and consequently all the eye-lashes are in contact with the globe of the eye. The second form is most common, and to this only the term Entropium is properly applied.

The causes of Trichiasis are by no means well understood—ulceration and consequent cicatrices are supposed to have produced it in most cases, but of this there is no proof. It seldom occurs in the under eye-lid.

The consequence of the inversion of the eye-lids is a constant irritation and inflammation of the eye, from which the cornea becomes opaque; but the patients from time to time relieve themselves by pulling out the cilia, and then the inflammation abates; it is, however, soon repeated when the eye-lashes begin to grow, and blindness sooner or later results; nor is this a termination of the patient's sufferings, for the inflammation goes on, and the pain continues. A callosity and complete change in the structure of the eye is the only event which affords a complete relief to the unhappy sufferer.

A great variety of means have been proposed and adopted for the cure of this disease, which it is unnecessary here to detail.

In reflecting on the nature of the complaint, several years ago, I was induced to think that the eye-lid could very readily be cut half off, without much inconvenience, because the orbicularis muscle is capable of contracting in such a degree as to throw the folds of skin into numerous wrinkles, thereby demonstrating that much of it could be removed, and the eye still be closed. A case of trichiasis came under my care in the Philadelphia Almshouse, in July 1810, in which several operations had been performed, but without effecting a cure: about one-third part of the cilia were inverted. In this case I made an incision through the tarsus, and cut out completely all that portion of the eye-lid, from which the cilia proceeded. My patient in a few days was perfectly cured, was extremely pleased with the operation, and very little disfigured; indeed, compared with her inflamed eye, her appearance was improved. Encouraged by the success of this case, I have twice since performed the operation of removing totally the lower half of the tarsus cartilage, together with the skin covering it and the inverted cilia; the success has been complete in both cases—the wound healed up very readily, the inflammation quickly subsided, and the opacity of the cornea was soon removed.

By one of those coincidences which are often occurring, the late Mr. Saunders, of London, contrived and performed the same operation, and with equal success. A small volume on the diseases of the eyes, which for the first time I saw during the present winter, though it was published in 1811, contains an account of this operation. Mr. Saunders remarks, "the certainty of its relieving the patient, is what I more value than the credit, if there be any, of having suggested it;" and in this sentiment I heartily join him. I shall therefore proceed to describe the manner of operating proposed by Mr. Saunders, aud afterwards relate my own method.

Mr. Saunders directs the operation to be performed as follows: "a piece of thin horn or a plate of silver having a curvature corresponding with that of the eyelid, is to be introduced, and its concavity turned towards the globe within the eye-lid which is to be stretched upon it. An incision is to be made through the integuments, and orbicularis palpebrarum, immediately behind the roots of the cilia to the tarsus, and should extend from the punctum lachrymale to the external angle. The exterior surface of the tarsus is then to be dissected until the orbital margin is exposed, when the conjunctiva is to be cut through directly by the side of the tarsus which must now be disengaged at each extremity; the only caution necessary being to leave the punctum lachrymale uninjured."

The manner in which I have performed the operation is extremely simple. A hook is passed through the edge of the eye-lid in order to gain a secure hold of it, and with a pair of sharp scissars the necessary portion of the eye-lid is removed by two or three cuts. "Nothing can be more simple that this piece of dissection." A remark applied by Mr. Saunders to his operation, but which is much more applicable to mine. The punctum lachrymale must be carefully avoided.

The wound generally heals in a few days; no dressings are necessary, but a soft compress may be lightly bound over the eye. Mr. Saunders says a fungus arose from the cicatrix in all his cases, which required caustic or the knife; all the cases I have seen, healed immediately without any inconvenience, and the deformity is not so great as would be imagined.* The appearance of the eye after the cure, is represented in Fig. 2. of the Plate next succeeding.*

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* The operation is I believe new, though Haller in his Bibliotheca Chirurgica states, that Rhazes recommended cutting and burning the eye-lid, in similar

When the eye-lids are contracted by cicatrices so as no longer to cover the eye, systematic writers have called the affection LAGOPHTHALMY, or hare-eye. I have seen it in consequence of burns and there is no remedy but careful dissection of the surrounding parts, by which the skin may be loosened in sufficient quantity to defend and cover the eye; after the dissection care must be taken to prevent by adhesive plaster or even a suture if requisite, the subsequent retraction of the skin.

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cases; the nature of his operation I cannot ascertain, as the only copy of Rhazes which I have been able to see, contains nothing on the subject. It is a black letter edition, very ancient in barbarous Latin, belonging to the Loganian library in this city.

* Since my first edition an enlarged experience has convinced me of the propriety of this operation.

CHAPTER LII.

Of Ophthalmia.

INFLAMMATION of the eye, or in medical language *ophthalmia*, is a frequent, and very distressing complaint. Its symptoms are very well known; they generally commence with a severe pain in the eye, redness of the eye-ball, and a copious secretion of tears—the patient is unable to bear the light, and keeps his eyes closed—sometimes a violent burning is perceived in the eye; head-ache and in general fever attend—the inflammation is either seated in the adnata, or in the globe of the eye, in which latter case there is less external evidence of inflammation, but the same general symptoms. In some cases an effusion of blood takes place into the cellular texture under the adnata, and occasions a great tumefaction.

Coagulating lymph is sometimes poured out by the inflamed vessels, and opacity of the cornea is the consequence. In some cases a pimple or inflamed speck appears in some part of the adnata, generally in the vicinity of the cornea. Small red vessels are often seen ramifying over the cornea.

It is unnecessary to enumerate the various causes of ophthalmia; they are numerous mechanical and chemical irritants, and certain diseases, as small-pox, syphilis, scrofula, catarrh, &c.

When the disease occurs in the adnata only, the pain is tolerable, compared with the sufferings of those patients in whom the internal parts of the eye are affected with severe inflammation; in these the pain is excruciating, and if it be not soon relieved, blindness is generally the result, and death sometimes takes place.

The treatment of ophthalmia, whether confined to the adnata, or seated more internally, consists in the active employment of the usual remedies for inflammation. Of course the remote causes, if they continue to act, should be removed; all extraneous matters which may irritate the eye should be wiped off; this may generally be done by passing a small piece of rag wet with clean water upon the end of a probe, round the eye between the eye and lid, or by injecting a stream of milk and water under the eye-lids by means of a syringe. In many cases, however, the foreign substance sticks in the cornea or sclerotica, and cannot be thus easily removed. It is very common for blacksmiths, in filing iron, to detach small portions of the metal with great force, so that when they strike the eye, they penetrate to some depth. In these cases the point of a lancet, or a cataract knife, must be used to detach the foreign body.

The remote causes being removed, blood-letting is to be performed, as extensively as the nature of the case may require. After this remedy has been carried as far as may be necessary, topical bleeding by leeches, and cupping in the neighbouring parts is to be next used. The European surgeons do not employ blood-letting so extensively in ophthalmia, as is necessary in the treatment of the complaint in this country. I have known, in one case, seventy bleedings required for the cure of an obstinate acute ophthalmia; the quantity of blood lost at each operation was generally six or eight ounces. In the Pennsylvania hospital, I have generally directed the patients afflicted with acute ophthalmia to be bled every second day, and on the intermediate day to be purged; to live upon a very abstemious diet, and to remain constantly in a dark room. These remedies are in almost every recent case, very speedily successful, and active measures ought surely to be preferred to tampering with serious diseases.

In some cases, after bleeding, and cupping, and leeches have been tried, if the inflammation continue, scarifications become necessary; the vessels of the adnata may be conveniently divided by the edge of a sharp scalpel, or the shoulder of a lancet. A few drops of blood evacuated in this way, from the inflamed part, will often prove extremely serviceable.

Purges are to be frequently administered, the saline cathartics are generally employed, and antimonial preparations in combination with nitre are also useful.

Blisters to the back of the neck, or behind the ear, or to the forehead, are in many cases extremely beneficial; but Dr. Physick has introduced a mode of applying blisters, in cases of ophthalmia, which is more quickly useful than any other; the plaster is to be spread with the epispastic ointment covered with gauze, and applied directly over the eye, the lids being closed; in this manner the whole surface of the upper and lower eyelid, and a portion of the cheek, are blistered, a copious discharge of serum takes place, and great relief is in general immediately experienced. I have for several years availed myself of this practice, and have been much pleased with its efficacy. I was formerly in the habit of cutting off the cilia, and applying a strip of adhesive plaster to prevent the flies from coming in contact with the eye, but of this, if the blistering plaster be carefully prepared, there is no risk, and I have often omitted the precaution; indeed, the copious secretion of tears would wash out any extraneous matter which might be insinuated between the eye-lids.

When, notwithstanding a vigorous perseverance in the use of the preceding remedies, the inflammation continues unabated, and great pain is felt in the ball of the eye, mercury should be administered in such a manner as to excite a speedy salivation, the ointment should be rubbed upon the thighs, and calomel administered in doses of two or three grains in the twenty-four hours.

No collyrium but of the mildest kind should be employed during the acute stage of ophthalmia. Milk and water answers very well. The pith of sassafras, infused in water forms a mild mucilage, which in these cases is a very pleasant application to the patient; the young twigs of the sassafras split open, afford considerable quantities of pith; a teaspoonful will render eight ounces of water sufficiently viscid. A soft light poultice of bread and milk sometimes relieves the pain of ophthalmia, but in general compresses of soft linen, wet with cold water or milk and water often changed, give more ease; the poultice keeps the part too hot, and its weight is an inconvenience.

After the more active symptoms of inflammation have abated, the employment of gently irritating or astringent collyria, becomes useful; the formula I have found most beneficial is the following:

R.	Sacchar: saturn:	(Acetatis plumbi)	gr. v.
	Vitriol: alb:	(Sulphatis zinci)	gr. iij.
	Laud: liquid:		ʒ. ij.
	Aq: fluvial:		℥. iv.
M.	f. collyr.		

The addition of ʒij of vinegar sometimes improves the medicine. Dr. Physick employed tar water several years ago in a most obstinate case of ophthalmia, which had resisted all the usual remedies, it proved completely and speedily successful.

In the employment of an eye-water, a rag wet with the fluid should be placed over the eye-lids, and occasionally they should be opened so as to admit it into contact with the ball of the eye. The tar water should in the first instance be diluted, and afterwards applied of the usual strength. Diluted laudanum, and the vinous tincture of opium, are in some cases very useful as collyria. A great variety of collyria have been contrived; I have already named those which appear to me most useful.

In general by these measures the inflammation is relieved; but it sometimes terminates in suppuration, and pus is poured out under the cornea, forming the disease called HYPOPION. In these cases it is proper to make a puncture with a cataract knife through the cornea for the evacuation of the pus; for if this be suffered to remain until ulceration takes place, vision will inevitably be destroyed. It generally happens, however, that brisk purging, and a continuance of the antiphlogistic measures, produce an absorption of the effused pus, and render it unnecessary to puncture the cornea.

Confinement to a dark room, and a very abstemious vegetable diet, should be enjoined during the whole course of the disease. Setons and issues in chronic cases are sometimes useful; they may be made on the back of the neck. When the inflammation abates, light should gradually be admitted to the eye, and a very cautious return made to the usual habits of diet and exercise.

Within a few years much attention has been excited in England by an epidemic ophthalmia, evidently contagious, accompanied by a puriform discharge from the adnata. To this complaint the British surgeons have affixed the name of Egyptian ophthalmy, from its resemblance to the disease which occurred among the troops in Egypt, in the year 1801.

This malady commences with a sensation of irritation, as if from a mote; the white of the eye becomes suddenly red, and the lower eye-lid very vascular. In this stage it readily yields to active antiphlogistic remedies. If these be not employed, the disease advances; and in the second stage the upper lids inflame, and secrete a "scalding fluid," which excoriates the cheeks, and suppuration soon follows. The remedies for inflammation are still proper, and sometimes successful; but if they are not, the third stage comes on, the cornea inflames, becomes opaque, and ulcerates.

Numerous treatises on this subject have appeared in the medical writings of Great Britain. An excellent history of it may be seen in Mr. MacGregor's paper, describing the disease as it occurred in the military asylum at Chelsea, in the 3d vol. Medico-Chirurgical Transactions. Sir William Adams has been very successful in the treatment of the Egyptian ophthalmia. His practice has been approved by the most respectable surgeons of London, and consists in copious depletion in the early stage; and in the latter, cutting off with a knife the granulations which arise from the adnata, and irritate the cornea. For a minute account of this and other diseases of the eye, the reader is referred to his excellent treatises written in 1812 and 1817.

In cases which I presume to call Egyptian ophthalmia, I have cut off the granulations of the adnata with obvious advantage.

CHAPTER LIII.

Unguis or Pterygium.

UNGUIS OR PTERYGIUM, is an affection of the eye, not unfrequently met with; it consists in an enlargement of the vessels of the adnata proceeding from the inner canthus of the eye, and at length forming a dense opaque red membrane of a triangular figure pointing and progressing towards the cornea, over which at length, it gradually spreads and of course impedes vision, in proportion to its extent. In some rare cases it proceeds from the external canthus of the eye. Scarpa observes that the unguis in some rare instances proceeds from other parts of the globe of the eye, but always maintains a triangular shape,—the apex of which is presented towards the cornea; occasionally two or three pterygia form upon the same eye; when these unite upon the cornea, a complete obstruction to vision takes place.

Scarpa considers the vessels of the eye in chronic ophthalmia to be in a varicose state, and in the present case in addition to the varicose state of the vessels which are extended over a certain part of the cornea, there is a preternatural thickening of the thin lamina of the conjunctiva which covers it, upon which these small varicose veins are situated.

Hence it seems that the pterygium appears at first, to be a new membrane formed upon the cornea, while it is nothing more than the fine lamina of the conjunctiva, forming its natural external covering, which in consequence of chronic ophthalmia has degenerated from a transparent into a thick and opaque tunic interwoven with varicose vessels.

Scarpa supposes the unguis to be nothing more than an increase of the same affection which forms NEBULÆ, or spots on the cornea. These nebulæ consist of dilated knotty vessels upon the cornea, which ought in their forming state to be treated by astringent collyria, and stimulating applications, as the citrin ointment, &c. in order to prevent their extending over the lucid cornea and thus impeding vision. A peculiarity of unguis or pterygium is that it appears very loosely connected with the sclerotica; if taken hold of by a hook or forceps it moves easily, and seems connected only by loose cellular texture. Scarpa remarks that cancer has sometimes resulted from this complaint.

The remedy consists in seizing the thickened membrane with a hook or pair of forceps and dissecting it carefully off with a pair of curved scissors, (Fig. 3.) Where it adheres to the cornea the union is more intimate, and here a sharp knife is the most proper instrument for the dissection. It is most convenient to commence the incision near the canthus and proceed towards the cornea.

Scarpa remarks that in some cases after the removal of the pterygium, the cicatrix prevents the freedom of motion outwards, to avoid which inconvenience in the treatment of pterygia which have a very extensive base upon the white of the eye, he has found it convenient to divide them from the apex, only as far as the cornea and sclerotica unite, and then to separate them at their base by a semicircular incision including about a line in breadth of the substance of the conjunctiva, in a direction concentric to the margin of the cornea. By operating in this manner, he has found that the after-treatment is much shorter, than when it is executed after the common method, that the cicatrix does not form a ridge or frænum, and that the conjunctiva being stretched circularly and equably upon the white of the eye by the cicatrix, loses that relaxation and varicose state of its vessels which formed the base of the pterygium. This nicety however, is not necessary where the pterygium is small, and does not extend much upon the white of the eye.

After the operation no particular dressings are requisite, a wet compress should be loosely bound upon the eye and the patient for a few days confined to a low diet.

A species of disease very analogous to this is called ENCANTHIS; it is a tumour of the same texture as the unguis and formed in the same manner, growing from the caruncula lachrymalis and semilunar fold of the adnata. It is to be extirpated by sharp scissors.

CHAPTER LIV.

Opacity of the Cornea and Artificial Pupil.

INFLAMMATION of the eye sometimes terminates in opacity of the cornea. Several distinct appellations have been given to the various forms of opacity in the cornea, as nebula, albugo, leucoma, &c.; for an account of these I refer to Scarpa.

In some cases the texture of the whole cornea appears to be changed, in others opaque spots are visible; sometimes the opacity depends on increased vascularity and subsides when the inflammation is over, in others it remains permanent.

Some practitioners are in the habit of blowing into the eye powdered sugar, molasses, white vitriol, or pulverized glass, with a view to grind off this film, as they call it; the practice is extremely pernicious, and ought never to be used; the remedies for inflammation already recited are the only ones in which confidence should be placed. When a portion of the cornea remains lucid, an artificial pupil if necessary, may be made opposite to this lucid spot in the cornea, and thus vision will be restored; the operation should not be performed unless the patient has lost the sight of both eyes. The same operation may also become necessary, in cases where the pupil has become obliterated, from an adhesion of the iris at its margin, in consequence of inflammation. In both these cases Dr. Physick has for many years been in the habit of making a section of the cornea, as for the extraction of cataract, and afterwards of removing a portion of the iris, by means of a pair of forceps terminating in narrow extremities upon one of which is fixed a sharp circular punch (Fig. 12.)

the iris in cases where the pupil is obliterated, must be punctured by the point of the knife in making the section of the cornea, and then the forceps can readily seize it. A variety of methods have been contrived for effecting this purpose.

Baron Wenzel's I think is preferable to all *before* described. The one I have just noticed is an improvement of Baron Wenzel's.

Mr. Charles Bell remarks that he had thought it possible to restore sight by making an artificial pupil, in cases of opaque cornea; what he considered possible, I have seen accomplished in a variety of cases. Indeed the advantages of the operation would be limited to a very narrow boundary if it were only adapted to cases in which the pupil is obliterated, because this is a very rare case in comparison with opacities of the cornea.

A portion of iris ought in most instances to be removed, because a simple puncture or incision through it is apt to contract, and of course it becomes necessary to repeat the operation.

Professor Scarpa has lately contrived a mode of forming artificial pupil which consists, not in making an aperture through the iris, but in separating the iris from the ciliary ligament. The patient being seated, and held as in the operation for cataract, a couching needle is to be introduced through the sclerotic coat, about two lines distant from the cornea; the needle enters on the side next to the external canthus, and its point is made to advance as far as the upper and internal part of the margin of the iris, that is, on the side next the nose. The instrument is then made to pierce the upper part of the internal margin of the iris close to the ciliary ligament, until its point is just perceptible in the anterior chamber of the aqueous humour. As soon as the point of the needle can be seen in the anterior chamber of the aqueous humour, it should be pressed upon the iris from above downwards, and from the internal towards the external angle; by this means a separation will be made of the iris at its margin, from the ciliary ligament and a black spot will be observed. The light can in this manner be transmitted to the retina.

I have mentioned the operation, because sometimes the only lucid part of the cornea is its margin, and in such cases, Scarpa's operation would probably answer extremely well, but under common circumstances Dr. Physick's is vastly preferable, because the pupil can be made wherever it is requisite, and with as little pain and difficulty as possible.*

Mr. Saunders has recommended the use of Belladonna to prevent the obliteration of the pupil, when the iris is inflamed: it produces a great dilatation of the pupil. Stramonium has been employed in this country with the view of dilating the pupil in certain cases, and would probably be equally effectual in this; indeed most of the narcotic plants possess the same property.

ULCERS OF THE CORNEA.

These sometimes form in consequence of inflammation, and sometimes an accidental injury ends in ulceration. The application of lunar caustic is the proper remedy. It is to be scraped to a point; secured in a quill, and then applied to the ulcer, and suddenly removed; the slough separates in a day or two, and the operation is to be repeated; the pain and intolerance of light gradually diminish, and the ulcer generally fills up and cicatrizes. For more minute information on ulcers of the cornea, I refer to Wardrop's morbid Anatomy of the Human Eye.

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* It may not be improper in this place to ascribe the invention of the artificial pupil to Cheselden, his publication on the subject is contained in the Phil. Trans. for 1735. His mode of operating has lately been revived and modified by Sir Wm. Adams. See his works.

CHAPTER LV.

Fistula Lachrymalis.

THE tears secreted by the lachrymal gland after lubricating the eye, are taken up by the puncta lachrymalia, and conveyed to the lachrymal sac, whence they pass through the ductus ad nasum into the nose. This ductus ad nasum, however, is liable like all other canals in the body to stricture. Whenever in consequence of a stricture in this duct, the course of the tears into the nose is interrupted, they accumulate in the sac which becomes tumid, and upon being pressed they regurgitate and flow partly over the cheek, and partly through the nasal duct. The tumour is situated on one side of the root of the nose below the inner canthus of the eye. The tears are constantly overflowing the eye, because the sac being full the puncta can receive no more. To the disease in this state the term fistula is improperly applied. The patient experiences but little inconvenience from it, except a constant watery eye; no pain and inflammation exist. Eventually, however, the stricture becomes complete, the sac inflames and suppurates, and now a fistulous sore is formed which discharges tears mixed with mucus and pus. It is generally accompanied with inflammation of the eye, and often with caries of the os unguis. The puncta, in this stage are often obstructed, and no tears find their way into the sac, but all which are secreted pass over the eye-lids.

In the first stage of the disease which has been called EPIPHORA, and by Scarpa the PURIFORM DISCHARGE OF THE EYE-LIDS, while the lachrymal sac is entire, the only remedy necessary is to inject by means of a fine syringe, called from its inventor Anel's, a stream of warm water through the puncta lachrymalia which will wash away any thickened mucus or similar obstruction. The sac should be kept empty by frequent pressure. Scarpa recommends in addition to this washing out of the "via lachrymalia" the use of an astringent ointment, to be applied between the eye-lids and upon the ball of the eye. He prefers the celebrated ophthalmic ointment of Janin. It is composed of the following ingredients; hogs-lard half an ounce, prepared tutty and armenian bole of each two drams, white precipitate (calx hydrargyri alba) a dram. Scarpa dilutes the ointment at its first application by adding hogs-lard. By the use of these remedies the disease has in many cases been prevented from ulcerating and has been completely cured.

Mr. Pott who condemns the use of Mr. Anel's probes which were intended to pass through the lachrymal puncta into the nose, recommends the employment of the syringe; he found it, however, sometimes unsuccessful. Mr. Ware's testimony is in favour of the syringe of Anel; he injects warm water through the lower punctum and places a finger upon the upper one to prevent its escape. He repeats the operation four or five days in succession. If he is unsuccessful in forcing any of the fluid into the nose, he makes use of topical blood-letting, from the angular vein, or by a leech applied near the lachrymal sac. He also varies the injection, and tries the effect of a weak vitriolic or anodyne lotion. Mr. Ware has in some cases passed a fine gold probe through the punctum, when unable to force the fluid into the nose, and by gently insinuating this, he has overcome the obstruction, and immediately afterwards the injection has readily found its way through the ductus ad nasum.

Mr. Ware remarks that "when an epiphora is occasioned by an acrimonious discharge from the sebaceous glands on the edges of the eye-lids, it must be evident, that injections into the sac will be very insufficient to accomplish a cure, because the sac is not the seat of the disorder. The remedies that are employed must be directed, on the contrary, to the ciliary glands themselves, in order to correct the morbid secretion that is made by them; and for this purpose, I do not know any application that is so likely to prove effectual as the unguentum hydrargyri nitrati, of the new London Dispensatory, which should be used here in the same manner in which it is applied in common cases of the psorophthalmy. It will be proper to cleanse the eye-lids every morning, from the gum that collects on their edges during the night, with some soft unctuous application; and I usually advise to apply to them, two or three times in the course of a day, a lotion composed of three grains of white vitriol, in two ounces of rose or elder-flower water." Mr. Ware recommends whenever collyria are applied, to substitute for linen compresses, eye-glasses, or to apply the fluid by camel's hair pencils.

In the second stage of the disease, where the fistulous sore exists, or where the inflamed state of the parts precludes the hope of any other termination, a different mode of treatment becomes requisite.

When the abscess of the sac has actually formed, it is best to open it with a lancet, because a puncture of this kind leaves a smaller scar than the sore formed by the absorbents. A probe should now be passed if possible into the ductus ad nasum; if it enter readily a bougie should be introduced of a conical form, so as to dilate the canal at the part where the obstruction exists, and this bougie should be suffered to remain, and a superficial mild dressing applied to the sore. In some cases this simple plan succeeds effectually. If, however, a bougie cannot readily be passed, a silver style or short probe is to be substituted; the size and form of this instrument is represented in Fig. 17. The circular button on its extremity may be covered with black sealing wax, or court plaster; when this instrument is introduced, the patient must wear it for several months, care being taken to cleanse it twice or thrice a week, and to inject whenever it is removed, a stream of tepid water through the canal. It might be supposed that the tears during this time would flow entirely over the cheek; but this is not the case; they pass by the sides of the probe and moisten the nostril. Very little inconvenience is sustained by the patient in wearing the style constructed by Mr. Ware, and it occasions no more deformity than a small black patch. In six weeks sometimes the obstruction will be permanently removed, but as it occasionally recurs even when the style has been continued a greater length of time, I have been accustomed to direct its use for six months. Some of Mr. Ware's patients have worn it for years, all the tears passing by its side into the nose. A great advantage is derived by gradually increasing the thickness of the style. Dr. Physick employs three or four in succession, the last being double the thickness of the first.

Mr. Ware directs, if the disease has not yet occasioned an aperture in the lachrymal sac, or if this aperture be not situated in a right line with the longitudinal direction of the nasal duct, a puncture to be made into the sac at a small distance from the juncture of the palpebræ, and nearly in a line drawn horizontally from this juncture towards the nose, with a very narrow spear-pointed lancet. The orifice thus formed soon becomes fistulous round the style, and no irritation is experienced in the subsequent introductions of this instrument.

When the ductus ad nasum is completely obliterated, instead of any attempt to form a new passage in the old situation, it is the practice to perforate the os unguis. Mr. Pott used a trochar for this purpose, but an inconvenience occasionally follows the use of the trochar; the aperture closes up by the fragments of bone inflaming and reuniting; to obviate this, Mr. Hunter constructed an instrument like a shoemaker's punch, by which a circular piece of bone may be cut out completely, and then the aperture cannot again be closed. It is true that a dossil of lint, or a probe of lead, or a bougie, kept in the passage will prevent its reuniting; but if Mr. Hunter's plan be adopted there will be no need of this trouble. Mr. Ware recommends a nail-headed style to be worn in this case, as well as in those instances where the natural canal is to be dilated, but for this practice I think there can be no necessity.

The operation of removing a portion of the os unguis is very readily performed. The only necessary caution says Mr. Pott, "is to apply whatever instrument is used so that it may pierce through that part of the bone which lies immediately behind the sacculus lachrymalis, and not to push too far up into the nose, for fear of injuring the os spongiosum behind, while it breaks its way." Mr. Hunter recommends a piece of thin smooth horn to be passed up the nostril, to receive the circular punch, which is to be passed into the lachrymal sac and forced through the os unguis, till it comes in contact with the horn. When the perforation is completed, air passes out of the nose through the wound, and blood will flow through the wound into the nostril. The external opening may now be dressed with adhesive plaster and suffered to heal immediately. If carious bone exist it will be separated by the absorbents, and should fungus arise from the wound it is to be destroyed by caustic. Mr.

Ware's plan of introducing the style through the ductus ad nasum, and of continuing its use for a great length of time supersedes the use of this latter operation in all but a few rare instances in which there is complete obliteration of the nasal duct. He is entitled to the greatest credit for his improvements in the treatment of this disease.

CHAPTER LVI.

Of Cataract.

By this term is designated an opacity of the chrystalline lens or its capsule, or of both. The pupil of the eye, which is naturally perfectly black, becomes grey or white, except in some rare cases where it has a dark colour; the colour, however, is always distinguishable from the deep black of the pupil in a sound eye. In its commencement it occasions a weakness or dimness of sight, which increases until vision is totally destroyed. In general, cataract occurs in advanced life, seldom commencing before the age of forty; in some cases, however, it begins much sooner, and is in some instances congenital; in congenital cataract the capsule (according to Wenzel and Saunders) is generally opaque and the lens fluid and milky.

The causes of cataract are not very easily ascertained. Baron Wenzel found it most frequent among persons exposed to the light of strong fires, as blacksmiths, glass-blowers, &c. It now and then happens from external violence.

The disease generally commences without pain; the first symptom is commonly an appearance of motes, specks, cobwebs, or insects floating before the eye; the patient attempts to remove them, but without effect. The pupil at this time does not generally evince any morbid appearance, but as the disease advances, a settled mist or cloud obscures every object—vision is greatly impaired, and a turbid whitish appearance of the pupil begins to be observed. In some cases these symptoms proceed very slowly, and in others the entire obfuscation of the lens takes place in a few weeks. When the disease is fully formed the patient is generally able to discern the situation of a strong light; can distinguish day from night; or perhaps count the windows in a room, but is unable to discern most objects, and in some cases even this faint degree of vision does not exist.

In the incipient stage of the disease it is proper to employ certain remedies which are occasionally useful in preventing its formation. Bleeding, purging, and a low diet, are to be recommended; mercury has been supposed useful; setons, issues, and blisters, are also to be employed. In some cases, more especially where the disease has resulted from external injuries, these remedies have been found successful, and the opacity has been removed by absorption; but in general no such favourable termination is to be expected, and Wenzel declares that "internal remedies either of the mercurial or of any other kind, are inadequate to the cure of this disorder, and equally so whether opacity be in the chrystalline or in the capsule, whether incipient or advanced." This is not quite correct; I have seen one patient in whom the lens or its capsule was universally opaque, and the pupil perfectly white; and this opacity subsided in the course of four or five months; the chief remedies employed were bleeding, purges, and mercury; how far they were serviceable I am not able to determine, for Pott and Hey both remark that cataract from external violence sometimes subsides spontaneously—the case alluded to was consequent to a wound of the eye.

Mr. Ware believes in the occasional absorption of the opaque chrystalline, and recommends to expedite it, by the application of a drop or two of æther to the ball of the eye once or twice a day, together with friction over the eyelid with a finger smeared with mercurial ointment. Little confidence is to be placed in such remedies, and it is now very generally conceded that the only method of restoring sight to persons afflicted with cataract, is to remove the opaque chrystalline from the axis of vision; this may be done either by *extracting* it, or by *depressing* it to the bottom of the eye. Both of these operations are performed by surgeons of the present day, and each has powerful advocates among the most respectable members of the medical profession. Other operations have recently been invented for the cure of cataract which shall be described presently.

Before comparing the merits of the two operations, it will be proper to enquire what cases of cataract promise to terminate successfully. Scarpa observes, "it is easy to determine whether an operation can be performed with a prospect of success or not. A favourable issue may be expected whenever the cataract is simple, or without any other disease of the eye-ball; in a subject not quite unhealthy or decrepid, and in whom the opacity of the chrystalline humour has been gradually formed without having originated from any external violence, or habitual ophthalmia, especially the internal; where there has not been frequent pain in the head, eye-ball, and supercilium; where the pupil, notwithstanding the cataract, has preserved its free and quick motion, as well as its circular figure in different degrees of light; and lastly, where notwithstanding the opacity of the chrystalline lens, the patient retains the power, not only of distinguishing light from darkness, but also of perceiving vivid colours, and the principal outlines of bodies which are presented to him, and where the pupil has that degree of dilatation which it is usually found to have in a moderate light."

When the pupil does not contract and dilate in various degrees of light, there is reason to apprehend gutta serena (paralysis of the optic nerve and retina) but in some cases of gutta serena, even in both eyes this contractility of the iris exists, and on the other hand, cases have occurred where no motion could be observed in the pupil, in which, nevertheless, the operation of extraction has proved the retina to possess its power of vision as usual; the probable cause of the immobility of the pupil in these cases, is adhesion between the posterior surface of the iris and the anterior portion of the capsule of the chrystalline lens. These are to be considered however very rare exceptions to a general rule.

In distinguishing gutta serena from cataract, the colour of the pupil is to be considered; it is black in the former disease, and turbid and lighter coloured in cataract; but Wenzel has met with black cataracts, in which scarcely any change could be detected in the colour of the pupil.

Both Wenzel and his commentator, Mr. Ware, believe it possible to distinguish the blackness of a cataract from the natural blackness of the pupil. De Haen and Van Swieten have been mistaken, yet they were not professing oculists. Mr. Ware decides boldly that "it is a rule as certain as almost any in surgery, that when an eye in a state of blindness, is accompanied with a clear black pupil which is incapable of varying its size according to the degree of light to which the eye is exposed; this blindness is produced by a defect of sensibility in the immediate organ of vision, and removable only by the application of proper stimuli to rouse it again to its natural action."

To ascertain with precision the nature and consistence of a cataract by examination is perhaps impossible. Scarpa says "all that has been hitherto written and taught upon this subject, has not that degree of certainty which can serve as a guide in practice, and the most experienced oculist of the present day is not able to determine with precision what the nature and consistence of the cataract is, upon which he proposes to operate, nor whether the capsule be yet transparent or not, although the lens be evidently opaque. For it is an indisputable fact, that the capsule sometimes preserves its transparency when the lens does not. The want of accurate notions however, upon this subject does not materially influence the success of the operation, as the surgeon ought in every case to be prepared to employ such means as the particular species of cataract which presents itself to him, may require during the performance of the operation, whether hard or soft, accompanied by opacity of the capsule which invests it, or not. The firm chrystalline cataract undoubtedly admits of being more easily removed by the needle from the axis of vision than any other; and does not rise again to its former place, if the surgeon in removing it from the pupil, use the precaution of burying it in the vitreous humour. The soft, the milky, or the membranous cataract, however, when met with in the operation, may be also removed from the pupil, effused or lacerated with the same needle, without the necessity of introducing any other instrument into the eye."

In the next place it will be proper to compare the advantages of EXTRACTION and DEPRESSION as remedies for cataract. Scarpa says truly that "in the warmth of discussion the advantages of the one, and the disadvantages of the other, have been exaggerated by both parties."

The most ancient of these operations is depression or couching. The extraction was not performed till near the conclusion of the seventeenth century. Freytagius Lotterius, and Wenzel, are the principal surgeons concerned in contriving and perfecting the operation of extraction. The last named oculist had wonderful success in the latter part of his life (though he confesses that he spoiled a "hat full of eyes" before he learned how to operate) and his son who succeeded him, was also extremely celebrated. He remarks in his treatise that "the accidents which are charged upon the operation of extraction may be reduced to the eight following;—first, the staphyloma;—secondly, pain;—thirdly, the discharge of the vitreous humour;—fourthly, the irregularity of the pupil;—fifthly, the deformity of the cicatrix;—sixthly, the closure of the pupil;—seventhly, the secondary cataract; and eighthly, the section of the iris.

First. With regard to the staphyloma; Wenzel remarks "that the mode in which the cornea is divided most commonly prevents this accident, by hindering the iris from coming forwards. But if such an accident should at any time happen, notwithstanding this care to prevent it, it may be reduced by merely rubbing the eyelids; and it does not occasion those ill effects which some authors have dreaded.

Secondly. The unavoidable pain that attends the operation of extraction is to be moderated, as in other operations by general remedies. It is, however, notwithstanding the assertion of a late author, less severe than that which is produced by depression.

Much has been said respecting the comparative pain of the two operations: I do not consider it an object of great magnitude to decide this contest, because it must be conceded on all hands that if an important advantage is to be gained by a temporary addition to the sufferings of the patient, this slight evil should not enter into competition with a permanent benefit; and it is notorious to all who are conversant with the subject, that neither couching or extraction, are to be considered as very painful operations. Notwithstanding this, from what I have seen, and I have seen very numerous cases where extraction has been performed, and some cases of couching, I am very decidedly of opinion that couching is the more painful operation. One patient in particular I recollect who had been couched, and whose cataract had resumed its situation, when the operation of extraction was finished (which was performed on the other eye) exclaimed, "is it possible the operation is over? it was not half so severe as the couching." I have never heard a single patient complain of much pain during the extraction of a cataract, but have often heard them express great astonishment at having suffered so little.

Thirdly. The escape of the vitreous humour if the operation be properly performed, will seldom take place. In some cases, however, notwithstanding every caution, portions of this fluid will escape. Wenzel thinks that although this is a slight evil, yet the clear perception of objects is sometimes diminished by this accident; but I have known a very considerable quantity of vitreous humour lost in several instances, in which not the slightest inconvenience resulted, but the cure was perfected as well as in the most successful cases. This is therefore no objection to the operation of extraction; first, because the escape of vitreous humour can generally be prevented; and secondly, if from its unusual fluidity, or any other cause, a portion of it should escape, no harm results from its loss.

Fourthly. An irregularity of the form of the pupil is an occasional consequence of the extraction of a cataract, —but I would observe that it is a very rare accident, and of little moment when it occurs. The shape of the pupil is of no great consequence, and though I do not agree with Wenzel that it becomes an advantage by enlarging the aperture through which the rays of light are to pass, yet I do maintain that patients see as well in whom some irregularity of the pupil exists, as they in whose eyes the pupil is a perfect circle.

Fifthly. The cicatrix of the cornea. "If the incision be made with one instrument and one stroke, if it be near the margin of the sclerotica and large enough to allow the opaque chrystalline to pass through it without violence; in this case the cicatrix will be scarcely visible and will not at all obstruct the rays of light in their passage to the retina." When the incision is made originally too small and is enlarged by means of scissors, the cicatrix becomes opaque, but if it be near the sclerotica it does not, even if opaque, interfere with vision. In general it is impossible to discern a vestige of the wound made in the cornea.

Sixthly. A total closure of the pupil. This I never saw, and Wenzel asserts that it is much more frequent after couching: certainly the iris is often scratched and injured by the needle used in the latter operation, and of course is liable to inflammation from which this closure generally arises.

Seventhly. A secondary cataract, or opacity of the capsule of the lens. This happens both after extraction and couching, and I know not which it most frequently succeeds; Wenzel of course says it is most common after couching. One thing is certain, that if the capsule be found opaque it is easily removed at the same time with the lens; if it become opaque afterward, a repetition of the section of the cornea will readily enable the surgeon to extract it.

Eighthly. A wound of the iris by the edge of the knife. This accident it is generally in the power of the surgeon to prevent. It commonly arises (except in awkward hands) from an escape of a small portion of aqueous humour at the puncture made by the knife in passing through the cornea; whenever the iris is found floating before the edge of the knife, as in (Fig. 11.) a gentle friction should be made upon the cornea with one finger of the hand which is at liberty, and the iris in this way becomes disengaged from the edge of the knife. Whether the friction acts by stimulating the iris to contract or whether by pressure on the cornea the iris is stretched at its margin, and thus mechanically disengaged, is not easily ascertained. Mr. C. Bell (without much experience in the operation) recommends pressure, and gives what he calls "an intelligible reason" for it. The fact is that friction succeeds immediately in reducing the iris to a situation behind the knife, and how this is effected is of no sort of consequence.

Mr. Hey for whose judgment in common with the medical world, I entertain a very high respect, differs with Ware and Wenzel, and prefers the operation of couching to extraction. Scarpa who has attended with great diligence to the subject, prefers couching; and to such authority great deference is unquestionably to be paid. Each of these gentlemen has invented a couching needle different from that in common use, and never perform any other operation than depression.

Scarpa has offered no defence of couching, but roundly asserts that "observation and experience, the great teachers in all things, seem to have decided in favour of the ancient method of treating the cataract, or that by depression." Mr. Hey on the contrary, enters into a laboured vindication of the operation, against the attack of Baron Wenzel.

The Baron alleges against couching many evils which probably in the hands of Scarpa or Hey, never have occurred, and like most other disputants has urged his objections in language too strong and general.

The consequences to be dreaded from couching he states under eight distinct heads; *first*, great pain at the time of the operation and subsequently to it; *second*, vomiting from a wound of the ciliary nerves, occasioning collections of matter; *third*, pain and suppuration of the eye from puncturing the retina; *fourth*, violent long continued pain in the eye, sometimes during life; *fifth*, bleeding into the cavity of the eye occasioning suppuration; *sixth*, the impossibility of depressing fluid or milky cataracts; *seventh*, the rising again of the lens;[*] *eighth*, wounding the ciliary processes. Enlarging on these ideas Wenzel very strongly contends in favour of extraction, and Mr. Hey taking up each of the arguments very ingeniously endeavours to refute them, and states that the pain in couching is very trifling;—that the vomiting seldom occurs, and when it does, is removed by an opiate;—that suppuration of the eye—that the long continued pain and bleeding within the eye, he never has met with in *his* practice.

The milky cataract Mr. Hey declares "has in some respects the advantage over a hard one, as the former is less apt to adhere to the iris, and consequently there is less risk of deranging the ciliary processes or their investing membrana nigra, by *breaking down* a soft cataract than by removing a hard one." Mr. Hey confesses, however, that "the softness of the cataract generally requires a repetition of the operation but does not prevent the patient from receiving a cure." The objection that the cataract if depressed is liable to rise again, Mr. Hey admits to be "true, but of little consequence. A repetition of the operation is not in this case always necessary, as the chrystalline will sometimes spontaneously subside and disappear, and when it does not, a repetition of the operation has never failed within the compass of *his* experience of being attended with success."

The wound of the ciliary processes, Mr. Hey prevents by a change in the shape of the needle which instead of being spear-pointed should be square.

Mr. Hey further states that the opaque capsule though it cannot be depressed may be so lacerated by the needle, as soon to be absorbed. Mr. Hey does not believe with the Baron that a closure of the pupil or an opacity of the capsule of the lens, are to be considered as solid objections against couching.

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[*] The lens has been found undissolved seventeen years after couching.

Mr. Hey when he quits his defensive attitude, and attacks the operation of extraction by replying to Baron Wenzel and Mr. Ware, in their account of its advantages, appears by no means a powerful opponent. Uniting with Mr. Hey in the sentiment with which he closes his chapter upon cataract, I can declare with truth my wish "that that mode of operating may prevail which is most beneficial to the afflicted." I have no hesitation in deciding from what I have seen and read, and from having myself performed the operation (though not frequently) that extraction in a great majority of cases, ought to be performed in preference to couching, and I have no doubt that its advocates would be much more numerous, if the operation were as easily performed, for the greatest advantage which I conceive couching to possess is the facility with which it is done; it is in fact an operation, requiring very little dexterity or science. I shall describe both operations.

CHAPTER LVII.

Of Extraction.

It will generally be proper that the patient for a week before the operation be confined to a low diet—he should be free from catarrh and other diseases—coughing, sneezing, or vomiting would prove extremely pernicious after the operation. The seasons to be preferred are the spring and fall, when the weather is settled and mild.

The instruments necessary in the operation of extraction are a knife for dividing the cornea; the one to be preferred is the instrument invented by the elder Wenzel. "It resembles the common lancet employed in bleeding, except that its blade is a little longer and not quite so broad. Its edges are strait. The blade is an inch and a half long and a quarter of an inch broad, in the widest part of it, which is at the base. From hence it gradually becomes narrower towards the point, so that this breadth of a quarter of an inch extends only to the space of about one-third of an inch from the base, and for the space of half an inch from the point, it is no more than one-eighth of an inch broad."

One edge is sharp through the whole length of the blade, at the distance of a quarter of an inch from the base, this lower edge has a slight projection. The upper edge is divided into three portions for the space of five-sixths of an inch from the basis; this edge is blunt, and very little flattened. For the space of half an inch or rather six lines and a half* further towards the point, it is blunt and rounded, although very thin. The extremity of this edge to the extent of one-eighth of an inch from the point, is keen like the lower edge, in order to facilitate the conveyance of the instrument through the cornea—the handle is octangular. The knife is represented in Fig. 14.

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* A line is the twelfth part of an inch.

I have described it particularly, because much of the success of the operation depends upon the perfection of the instrument. Mr. Ware uses a knife very little different from Wenzel's; it is rather wider near the point, in order that the edge may quickly get below the inferior margin of the pupil and thus avoid wounding the iris.

It has been customary in operating on the eye to make use of a contrivance called a speculum to keep the eye motionless; a variety of specula have been constructed, but in the opinion of Baron Wenzel they are useless. In addition to the knife, a curette, or small scoop of silver or gold, and a curved needle of steel which are generally fixed to one handle (Fig. 15.);—a small steel hook (Fig. 18.);—and a pair of small forceps (Fig. 16.) are all the instruments required for the operation. Instead of the forceps copied from Wenzel, a more convenient form is that delineated (Fig. 4.) the extremities are to be flat, and their surfaces of contact when closed about the fourth of an inch.

OPERATION.

The patient is to be seated in a low chair before a moderate light which strikes the eye obliquely. Baron Wenzel directs the operator to proceed in the following manner.

"The sound eye being covered with a compress retained by a bandage, an assistant, placed behind, must hold the patient's head, and support it on his breast. With the fore-finger of the hand that is at liberty, he is then to raise the upper lid of the eye to be operated upon, and gently to press the tarsus, with the extremity of the finger, against the upper edge of the orbit. In order to assist this arrangement, and properly to fix the upper lid, the assistant should take care to draw up the skin over the orbit, and strongly to fold the teguments that support the eye-brow. By this method, the eye will be entirely uncovered, an undue pressure upon it will be avoided, the fingers of the assistant will not interfere with those of the operator, and the eye-lid will be so fixed as to be incapable of any motion.

"The operator is to be seated on a chair, a little higher than that of the patient. The eyes naturally turning towards the light, he is to place the head of the patient obliquely to a window; so that the eye to be operated upon may be inclined towards the outer angle of the orbit. This position of the eye will enable the operator to bring out the knife, on the inner side of the cornea, opposite to the part where it pierces this tunic, more exactly than he would otherwise be able to do. The operator is to rest his right foot on a stool, placed near the patient, that his knee may be raised high enough to support the right elbow, and to bring the hand with which he holds the knife, to a level with the eye on which he is to operate: (this direction I think unnecessary if the operator have a steady hand.) He is then to take the cornea knife in his right hand, if it be the left eye on which he is to operate, and, *vicê versâ*, in the left hand, if it be the right eye. The knife is to be held like a pen in writing, and his hand is to rest steadily on the outer side of the eye, with the little finger, separated a little from the rest, on the edge of the orbit. In this position he is to wait, without any hurry to begin the incision, until the eye which is usually very much agitated by the preparations for the operation, becomes perfectly still. This always takes place within a few seconds of time; and, therefore, as I have already fully expressed myself on this subject, every instrument invented to fix it is useless.

"When the eye is still and so turned towards the outer angle of the orbit, that the inner and inferior part of the cornea, through which the point of the instrument is to come out, may be distinctly seen, the operator is to plunge the knife into the *upper* and *outer* part of the tunic, a quarter of a line distant from the sclerotica, in such a direction, that it may pass obliquely from above downwards, parallel to the plane of the iris. At the same time, the operator must depress the lower lid with his fore and middle fingers, which are to be kept a little distant one from the other, and must take the greatest care to avoid all pressure on the globe, which is to be left perfectly free, as the surest way to diminish its power of moving.*

"When the point of the knife has proceeded so far as to be opposite to the pupil, it is to be dipped into this aperture, by a slight motion of the hand forward, in order to puncture the capsule of the chrystalline;† and then by another slight motion, contrary to the former, it must be withdrawn from the pupil, and, passing through the anterior chamber, must be brought out near the inferior part of the cornea, a little inclined to the inner angle, and at the same distance from the sclerotica, as when it pierced the cornea above. If the knife has been well-directed, and the fore and middle fingers of the hand opposite to that which holds the instrument, have been properly applied, the section of the cornea, thus completed, will be found sufficiently large; its shape will be semi-circular; and it will be quite near enough to the margin of the sclerotica." (WENZEL.)

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* Mr. Ware very properly condemns this direction, and advises the eye at this time to be moderately pressed, which certainly serves to fix it, and prevent its motion.

† Baron Wenzel's practice in this particular, is not to be imitated by any but experienced operators.

When the iris is unusually convex, and in making the section of the cornea becomes entangled before the knife, the cornea is to be rubbed downward with the finger, which disengages it. A fear of wounding the iris, should never induce the operator to make the section of the cornea at too great a distance from the sclerotica, because the section will in that case be too small to allow the lens to escape.

While the section of the cornea is proceeding, and when the point of the knife has passed out at the side opposite to the part at which it entered, the assistant lets the upper eye-lid drop, and all pressure is immediately taken off.

The next part of the operation consists in puncturing the capsule of the chrystalline lens, for I believe few surgeons have dexterity and confidence enough to do it, generally, with the cornea knife. The best mode of effecting this will be to introduce the needle (Fig. 15.) through the wound in the cornea, into the pupil, and move it gently, but freely and quickly, in all directions; by this manœuvre the anterior portion of the capsule will be lacerated, and a gentle degree of pressure being made upon the eye, the pupil is observed gradually to enlarge, and one edge of the lens is observed escaping through it; all pressure is to be immediately removed, and the opaque chrystalline escapes.

Sometimes it is necessary to assist its escape through the aperture in the cornea, by the use of the needle, or scoop, and any portion of opaque glutinous matter which remains behind are to be carefully removed by the curette. If the capsule be not opaque the pupil will now be observed to have regained its natural blackness, and the patient will discover the surrounding objects. In a majority of the cataracts which I have seen extracted, the centre has been firm and dense, but portions of the external part have been soft and glutinous, and have remained after the extraction of the central portion. If it be inconvenient to remove them all, it will be better to wait for their absorption than to augment the danger of inflammation by protracting the operation too long.

Sometimes the cataract, according to Wenzel, adheres, and must be separated by the needle from its adhesions, this is in general readily effected by inserting the needle in the lens, and moving it gently in different directions.

If the capsule of the lens be found opaque, it may now be extracted, by means of a pair of small forceps; those recommended by Wenzel, (Fig. 16.) are much too clumsy, they cannot, from their bulk, be readily opened and shut in the wound of the cornea, it is more convenient to have forceps resembling those delineated in Fig. 4.

The anterior portion of the capsule is most frequently opaque, and sometimes considerably thickened and indurated; when this is the case it comes out at once; if it be torn, however, the fragments are to be removed, and during this part of the operation, great care must be taken to avoid the escape of the vitreous humour; the eye should not be kept open long at a time, and the attempts to extract the portions of opaque capsule, should be repeated as often as necessary, but not continue more than a minute at a time, and the eye in the intervals should be covered with a small compress of fine linen wet with clear cold water.

Dr. Physick has, in some cases where the capsule was evidently opaque, extracted it first with the forceps; when this is done the lens descends below its usual situation, but its falling to the bottom of the eye "does not appear to be quite correct; it was in the cases alluded to, very easily extracted with a curved needle, or small hook, (Fig. 13.) this hook is occasionally useful in removing portions of the capsule as well as of the lens and should always be at hand.

The lens does, however, in a diseased state of the vitreous humour, descend in some cases to the inferior part of the eye, and in these cases pressure cannot be used, and it must be extracted with the hook.

If the capsule though lucid at the time of the operation should become subsequently opaque, forming what is called secondary cataract, the section of the cornea is to be repeated, and the opaque membrane removed. The subsequent treatment consists in preventing inflammation. The patient should lie on his back for eight or ten days, the room being somewhat darkened: the eye requires no dressing but a compress loosely applied: the hands ought in every instance to be secured to the sides of the bed by means of tapes, in such a manner as to prevent their reaching so high as the head, persons waking, are very apt to rub their eyes, and sight has been destroyed by such accidents, the caution just given ought therefore never to be neglected; a low diet, and if necessary from the accession of fever, bleeding and purging ought to be directed.

For much useful information on the present subject, the reader is referred to the writings of Mr. Ware, and Baron Wenzel.

CHAPTER LVIII.

Of Couching.

It has already been mentioned, that this operation consists in depressing the opaque chrystalline lens, and removing it from the axis of vision. The couching needles generally employed are these of Saunders, fig. 5; of Scarpa, fig. 6; and of Hey, fig. 7. No very particular description need be given. Scarpa's needle is, in my opinion, to be preferred; it possesses firmness enough to enter the eye without danger of its breaking, and has a point somewhat curved. The curved extremity is sharp at the edges, and polished and flat upon its convex dorsum; there is a mark on the side of the handle which corresponds to the convexity of the point. It should be made rather shorter than Scarpa directs. I shall quote the description given by this celebrated oculist of his operation.

OPERATION.

"Every thing being arranged for performing the operation, the surgeon should place his patient on a low seat, on the side of a window which has a northern aspect, so that the light coming from it may only fall upon the eye which is to be operated on laterally. The patient's other eye being covered, although affected with cataract, the surgeon ought to place himself directly opposite the patient, upon a seat of such a height, that when he is prepared to operate, his mouth shall be on a level with the patient's eye. And, in order to give his hand a greater degree of steadiness in the several motions which the depressions of the cataract require, the elbow corresponding to this hand should be supported upon the knee of the same side, which for this purpose he should raise sufficiently by resting his foot upon a stool, and according to circumstances also, by placing a small hard pillow upon his knee. An able assistant situated behind the patient, with one hand fixed upon the chin, should support the patient's head against his breast, and with the other placed on the forehead, gently raise the upper eye-lid by means of Pellier's elevator, carefully observing to gather the eye-lid against the arch of the orbit, without pressing upon the globe of the eye.

"Supposing then the eye to be operated on is the left, the surgeon taking the curved needle in his right hand, as he would a writing pen, with the convexity of the hook forwards, the point back, and the handle in a direction parallel to the patient's left temple; should rest his fingers upon the temple, and boldly perforate the eye-ball in its external angle, at rather more than a line from the union of the cornea and sclerotica, a little below the transverse diameter of the pupil, gradually moving the extremity of the handle of the needle from behind forwards from the patient's left temple, and consequently giving the whole instrument a curved motion, until its bent point has entirely penetrated the eye-ball; which is effected with the greatest readiness and ease. The operator should then conduct the convexity of the needle upon the summit of the opaque chrystalline, and by pressing upon it from above downwards, cause it to descend a little, carefully passing the curved point at the same time between the corpus ciliare and the capsule of the chrystalline lens, until it be visible before the pupil, between the anterior convexity of the capsule of the lens and the iris. Having done this he should cautiously push the hook with its point turned backwards towards the internal angle of the eye, passing it horizontally between the posterior surface of the iris, and the anterior convexity of the capsule, until the point of the needle has arrived as near the margin of the chrystalline and capsule as possible, which is next the internal angle of the eye, and consequently beyond the centre of the opaque lens. The operator then inclining the handle of the instrument more towards himself, should press the curved point of it deeply into the anterior convexity of the capsule, and substance of the opaque chrystalline, and by moving it in the arc of a circle, should lacerate the anterior convexity of the capsule extensively, remove the cataract from the axis of vision, and lodge it deeply in the vitreous humour, leaving the pupil perfectly round, black, and free from every obstacle to the vision. The needle being retained in this position for a short time, if no portion of opaque membrane appear behind the pupil, which would require the point of the instrument to be turned towards it, in order to remove such obstacle, (for with respect to the chrystalline, depressed in the manner now described, it never rises again) the surgeon should give the instrument a small degree of rotatory motion, in order to disentangle it easily from the depressed cataract, and should withdraw it from the eye in a direction opposite to that in which it had been introduced, that is greatly inclining and turning the handle towards the patient's left temple.

"In every species of cataract, with considerable opacity and density of the anterior hemisphere of the capsule of the chrystalline, the surgeon may very easily know during the operation, whether the curved point of the needle, insinuated between the corpus ciliare and the capsule, is exposed between the pupil and the anterior hemisphere of that membrane; or, whether having penetrated into the membranous sac of the chrystalline, it has only advanced between the anterior hemisphere of the capsule and the opaque lens. But when the capsule, notwithstanding the opacity of the chrystalline lens, preserves in a great measure, or entirely, its transparency, it is an easy matter for a young surgeon, not sufficiently conversant with this operation, to commit an error, and one of great importance, that is, to remove the cataract from the axis of vision, and lodge it in the vitreous humour, leaving the anterior convexity of the capsule untouched, which afterwards gives rise to the secondary membranous cataract.

"To avoid this serious inconvenience, every operator should be particularly careful to satisfy himself before making any movement with the point of the needle for depressing the cataract, that the curved extremity of the instrument is really, and not apparently, situated between the pupil and the anterior portion of the capsule, of which he will be convinced by the degree of light which the convexity of the hook presents to him, and the facility which he finds in pushing it forwards through the pupil towards the anterior chamber of the aqueous humour, and in moving it horizontally between the iris and anterior hemisphere of the capsule. In the opposite case he may be certain that the curved point is within the membranous sac of the chrystalline, by observing that the extremity of the needle is obscured and covered by a more or less transparent veil; that he meets with some resistance in pushing it through the pupil into the anterior chamber of the aqueous humour; and that in doing it, this membranous veil which covers the hook is elevated towards the pupil, and lastly, that the point of the needle is with difficulty conducted horizontally between the iris and the cataract, from the external towards the internal angle of the eye.

"The surgeon will remedy this inconvenience, by giving a slight rotatory motion to the needle, by which the point being forwards will pass through the anterior convexity of the capsule opposite the pupil; the point of the instrument being then turned backwards again, should be passed horizontally between the iris and the anterior hemisphere of the capsule towards the internal angle of the eye, and having reached this part should be boldly plunged into the capsule, and the substance of the opaque lens, in order to lacerate the former extensively, and to carry the latter deeply into the vitreous humour out of the axis of vision, and thus complete the operation.

"When, without observing this precept, the opaque lens is removed, or, more strictly speaking, enucleated from its capsule and lodged in the vitreous humour; and the anterior convexity of this membrane being left entire, is slightly opaque, the pupil will appear black, and so free from obstruction to the light as easily to deceive the young surgeon, and induce him to believe that the operation has been properly executed. But persons experienced in this part of surgery, will instantly perceive that the pupil under such circumstances, has not that just and perfect degree of blackness which it ought to have, and that this slight dimness is caused by an imperfectly transparent membranous veil, placed between the pupil and the bottom of the eye, which when suffered to remain, never fails, in process of time, to give rise to the secondary membranous cataract. In this case, the expert operator having depressed the opaque lens, should immediately turn the curved point of the needle forward, and pass it through the pupil into the anterior chamber of the aqueous humour, in order to perforate this semi-transparent membranous veil with the greatest certainty; then turning the point of the needle backwards and making it pass as far as possible between the posterior surface of the iris and this membrane, should press the point of the instrument into it and lacerate it from before backwards, making a movement as if he had to depress the lens again. In doing this he will have the satisfaction to see the pupil assume the deep black colour of velvet, and a degree of clearness which it had not before, although the opaque lens had been completely removed from the axis of vision.

"Hitherto I have supposed the cataract to be of a firm consistence, and to resist the pressure of the needle. But if the operator should meet with a fluid cataract, the milky for instance, which is not an unfrequent occurrence, when he has passed the needle between the corpus ciliare and the capsule, until it appears uncovered between the pupil and the anterior hemisphere of the membranous sac of the chystalline lens, and the curved point has been cautiously advanced between the iris and the margin of the capsule, nearest the internal angle of the eye; at the moment that the point of the needle is deeply pressed into the capsule and cataract, a whitish milky fluid will be seen to issue from the capsule, which extending itself in the form of a cloud or smoke, will be diffused through both the chambers of the aqueous humour, and obscure the pupil and the whole of the eye. The surgeon should not on this account lose his confidence, but, guided by his anatomical knowledge, should make the small hook describe the arc of a circle from the internal towards the external angle of the eye, and from before backwards, as if he were depressing a solid cataract, with a view of lacerating as much as possible, the anterior hemisphere of the capsule, upon which the favourable success of the operation principally depends, not only in this, but in every other species of cataract. For as to the effusion of the milky fluid into the chambers of the aqueous humour, it disappears spontaneously a few days after the operation, and permits the pupil and the whole of the eye to resume their former natural brightness.

"The method of operating which the surgeon should employ will be little different from this, if, during its performance, he should meet with a soft or cheesy cataract. The anterior convexity of the capsule should be lacerated as much as possible opposite the pupil, so that the opening may equal the diameter of the pupil in its ordinary dilatation. And with respect to the pulpy substance of the cataract, which, in such cases, remains behind, partly diffused in the aqueous humour, and partly swimming beyond the pupil, all that is necessary, is to divide the most tenacious parts of that substance, that they may be more easily dissolved in the aqueous humour, and to push those moleculæ of the caseous substance of the chrystalline, which cannot be sufficiently divided, through the pupil into the anterior chamber of the aqueous humour, in order that they may not be carried opposite the pupil, but being situated at the bottom of the anterior chamber, may be gradually dissolved and absorbed without obstructing the sight." (SCARPA.)

CHAPTER LIX.

Of Congenital Cataract.

The late Mr. Saunders of London, instituted an infirmary for the reception of patients afflicted with diseases of the eyes—he lived but a few years after its foundation, long enough however, to be very useful as surgeon to the establishment, and a small posthumous volume published in 1811, contains a number of highly interesting remarks on various affections of this important organ. The following observations on congenital cataract are extracted principally from his writings.

The causes of congenital cataract are unknown: it appears sometimes in several of the same family. Mr. Saunders saw sixty cases of the disease between June 1806, and December 1809, so that it is by no means unfrequent. He relates many cases where several children of the same parents were born blind.

The opacity is generally seated in the capsule; the lens being absorbed. Sometimes the lens is opaque, and solid or fluid as in adults. Mr. Saunders found that the only treatment necessary, was to perforate the centre of the capsule, and if a permanent aperture was made in that membrane, the lens if it existed was subsequently absorbed.

Children affected with the disease possess various degrees of vision. Some indistinctly see external objects, others can only discern bright colours or vivid lights. If the privation of vision be nearly complete, volition for want of an external object to attract these organs, is not exercised over the muscles belonging to them, and their actions are not associated, but the eye rolls here and there with rapidity, and trembles as it moves.

The excessive mobility of the eye, the unsteadiness of the little patient, the small field for the operation, and the flexibility of the opaque capsule, are the difficulties with which the surgeon has to contend. Mr. Saunders overcame them by fixing the eye-ball with a speculum, controlling the patient, dilating the pupil with belladonna, and by using a diminutive needle armed with a cutting edge from its shoulders to its point, and thin enough to penetrate with the most perfect facility. This needle is delineated in Fig. 5.

The extract of belladonna is to be diluted with water to the consistence of cream and dropped into the eye, or the extract undiluted may be smeared over the eyelid and brow. In half an hour, or an hour the pupil is fully dilated, and the application should be then washed off. The patient is confined in a proper position and in a situation near a window by a sufficient number of assistants, who take great care to fix the head motionless, and to secure the limbs from moving. The operator is seated on a high chair, behind the patient, takes the speculum in one hand and the needle in the other.

Should the capsule contain an opaque lens, the surgeon gently introduces the bow of the speculum under the upper eye-lid, his assistant at the same time depressing the lower, and at the moment he is about to pierce the cornea, he fixes the eye by resting the speculum with a moderate pressure upon the eye-ball. The position of the operator enables him to do this with perfect safety, and by that consent which can only exist between the hands of the same person, he not only discontinues the pressure, by using the speculum merely as an elevator of the lid, as soon as his purpose is accomplished, but he with facility renews or regulates the pressure at any moment in which it may be required. He penetrates the cornea as near to its junction with the sclerotica as it will admit the flat surface of the needle to pass, in a direction parallel and close to the iris, without injuring this membrane. When the point of the needle has arrived at the centre of the dilated pupil, he does not boldly plunge it through the capsule into the lens, and perform any depressing motion; it is a material object with him not to injure the vitreous humour or its capsule; neither does he lift the capsule of the lens on the point of the needle, and by forcibly drawing it forward into the anterior chamber, rend it through its whole extent. Such an operation would dislocate the lens, deliver it into the anterior chamber, or leave it projecting in the pupil, and stretching the iris; and although its soft texture in the child should exempt him from any disorganizing inflammation, the most favourable result will be a permanently dilated iris, deforming the eye. He proceeds with a gentle lateral motion, working with the point and shoulders of the needle only on the surface and centre of the capsule, in a circumference which does not exceed the natural size of the pupil. This object is *permanently* to destroy this central position of the capsule: merely to pierce it would not answer his intention, because the adhesive process will speedily close the wound. Having acted upon the centre of the anterior lamella of the capsule to the extent which he wishes, he gently sinks the needle into the body of the lens, and moderately opens its texture. In doing this he may, if he pleases, incline the edge of the needle, by which motion the aqueous humour will escape, and the lens will approach his instrument; but at the same time his field for operating will be diminished by the contraction of the pupil. The needle and speculum are now to be withdrawn, the eye is to be lightly covered, and the patient put to bed.

Inflammation is seldom excited by this operation on the child; but its first approach, marked by pain and unusual redness of the conjunctiva, or serous effusion under it, must immediately be arrested by the application of leeches on the palpebræ, and, in stouter children, by bleeding from the arm, followed by purgatives and a very low diet. Soon after the operation the extract of belladonna should be applied over the eye-brow, to prevent, by a dilatation of the iris, the adhesion of the pupillary margin to the wounded capsule. Nature now performs her part of the cure, and the lens, loosened in its texture, and through the aperture in the capsule, subjected to the action of the aqueous humour, is gradually dissolved and absorbed.

A single operation sometimes suffices, and the cure is completed in the space of a few weeks; but if the process should not advance with sufficient rapidity, the operation may be repeated once or oftener, interposing at least a fortnight between each operation. If the adhesive process has counteracted his former operation on the capsule, he will take care now to effect the permanent aperture in its centre, and he may use greater liberty than at first in opening the texture of the lens.

Some have supposed that the fluid cataract is not only the most frequent, but the most manageable of the congenital cases. Both suppositions are erroneous. It is not only the least common, but the fluid, when extravasated sometimes excites a hazardous inflammation. In these cases, after puncturing the anterior lamella of the capsule, and discharging its contents into the anterior chamber, it will be prudent to desist for the time, and to guard against inflammation: by this operation the case will be converted into a capsular cataract.

Where the lens is *nearly* or *quite absorbed*, and the capsule only is opaque, the surgeon may use the needle with more freedom than in the lenticular cataract, but in other respects he proceeds in the manner above described. If any portion of the lens remain as a small nucleus or scale, in the centre of the capsule, his efforts will be exclusively directed to detach this portion, by which he will fulfil the intention of the operation, that of effecting a permanent aperture in the centre of the capsule.

Mr. Saunders in some cases punctured the sclerotica and perforated the capsule from behind: he observes, that in this posterior operation the surgeon has more power, but that the anterior operation excites less pain and inflammation, and inflicts a slighter injury (if any) on the vitreous humour; from the facility with which the cornea heals I should prefer the anterior operation.

The number of operations which may be necessary to accomplish the cure of a congenital cataract, will depend much upon the texture of the capsule, and the size of the lens. It is frequently cured by a single operation; more frequently it requires two; often three; sometimes four; but very rarely five. In *sixty patients* Mr. Saunders, (the author of the operation) succeeded in giving sight to *fifty-two*. In thirteen he operated on single eyes. In forty-seven he operated on both eyes. The ages were as follows: five, from two to nine months; nine, from 18 months to two years; four, from two and a half to three years; five, from three and a half to four years; eight, from four to six years. Seven, at seven years; eight, from seven to nine; ten, from nine to fifteen; and four from twenty to twenty-eight. The greatest success attended the operation when performed between the ages of 18 months and four years. The age of two years is perhaps preferable to any other. It is extremely important to operate as early as possible, because, the muscles acquire an inveterate habit of rolling the eye, so that for a long time, no voluntary effort can control this irregular motion, nor direct the eye to objects with sufficient precision for the purpose of distinct and useful vision.

I cannot refrain in this place from expressing my high sense of the ingenuity of Mr. Saunders, in the contrivance of the simple and important operation which has been described. When the advantages of education are considered, and the necessity of sight for this purpose, the magnitude of the object will appear very great, and when the success of his practice is recollected, (52 cures of 60 patients) his skill and judgment cannot be too highly rated. Since Mr. Saunders' publication I have met with but one case of congenital cataract, (which from all the inquiries I can make, I believe to be extremely rare in America, as from Scarpa's account it is in Italy) but in that one case I succeeded in restoring vision, and my patient, now four years old, sees very well.

Before concluding this subject, I beg leave to suggest the propriety in cases of cataract where the pupil is greatly contracted, of using either the belladonna, as directed by Mr. Saunders, or the extract of stramonium, which operates in the same manner; great difficulty sometimes attends the extraction of the lens, owing to the contracted state of the pupil, the applications just proposed will probably be found to obviate this difficulty, and perhaps another, the entangling of the iris on the point of the knife, because the dilatation of the pupil, occasioned by stramonium and belladonna, is so great, that the iris actually resembles a narrow ring at the margin of the cornea.

The effect of certain narcotic plants in dilating the pupil of the eye, both when externally and internally administered, has been long known, but it is only a few years since surgeons have availed themselves of it, in examining cataracts, and facilitating their extraction. Mr. Wishart, in a paper published in the Edinburgh Med. and Surg. Journal, for January 1812, recommends very strongly the hyosciamus, and quotes professor Himly of Göttingen, who has made comparative experiments with belladonna and hyosciamus, and prefers on his authority, as well as from his own observation, the latter article. The mode of using it is, to dissolve a dram of the extract in an ounce of water, of which solution a few drops are to be let fall into the eye. It occasions no pain nor redness. The effect on the pupil commences in an hour, and continues five or six hours.

There are several advantages which may be gained by artificially dilating the pupil. I have known a lady blind except at noon; her pupil was no larger than a pin's head, the use of stramonium enabled her to see tolerably in various degrees of light. In examining cataracts, the larger the pupil, the more readily we may ascertain the circumstances of the case. It is always in the surgeon's power to learn whether the iris be adherent, in which case no dilatation of the pupil will be occasioned by the narcotic applications. In cases of partial opacity in the cornea, the dilatation of the pupil enables the patient to see by withdrawing the iris from behind a lucid part of the cornea, and thus forming a temporary substitute for an artificial pupil: the advantages of a dilated pupil during the operation of extracting a cataract, have been already mentioned; but an inconvenience has been dreaded from the escape of the vitreous humour, in consequence of a want of that support which the iris afforded. The experiments of Himly quoted by Wishart, appear to prove that this fear need not be entertained, and the surgeon may doubtless avail himself safely of the benefits which are to be derived from the application of these narcotics to the eye.

Among the consequences of the extraction of cataract, HYPOPION and STAPHYLOMA are the most formidable, happily they are of rare occurrence, I have never seen either. Hypopion is a collection of matter in the anterior chamber of the eye. The term EMPYESIS signifies a collection of pus in the posterior chamber, both are consequences of violent inflammation, and occasionally occur after ophthalmia.

In cases of hypopion the continued use of the remedies for inflammation seldom fails of producing an absorption of the pus;—as this absorption goes on, the pus being heavier than the aqueous humour falls to the bottom of the anterior chamber of the eye, forming a semicircle of a yellow colour, the circumference of which is formed by the cornea. It is very seldom necessary to puncture the cornea for the evacuation of the pus, active purges are to be repeatedly administered, but, if aided by the usual depleting remedies they are unsuccessful, a puncture must be made. These remarks apply equally to hypopion from inflammation of the eye arising from other causes.

The STAPHYLOMA is a tumour projecting through the wound of the cornea, formed generally of the iris, but in some cases of a transparent membrane, which Wenzel calls the capsule of the aqueous humour. When upon looking at the eye for the first time, which is generally done in six or eight days after the operation, the iris is observed protruding through the wound, no attempt should be made to replace it; as the opening in the natural cornea closes, the iris generally regains its situation. The tumour formed by a transparent membrane, is of a very different nature. The membrane is probably an adhesion formed of coagulating lymph, distended afterwards by an abundant secretion of aqueous humour; if cut off or destroyed, it generally returns again, which would not be the case if it were formed of an organized capsule. Wenzel recommends the case to be left to nature, the eye-lids gradually produce by friction and pressure, an absorption of the tumour. Staphyloma sometimes results from ulcers of the cornea; in these cases, if it continue obstinate and do not subside spontaneously, the lunar caustic must be applied.

Scarpa denominates the staphyloma formed by the iris "procidentia iridis," which is surely a more proper appellation, for it is perfectly distinct from the tumour just described, which is often pellucid, but when opaque is of a pearly white colour, and easily distinguishable from the protruded iris.

Staphyloma is sometimes occasioned by small-pox—in this case the tumour is of a white colour like the opaque cornea. In general it ulcerates and occasions inflammation of the eye; in these cases the tumour may be cut off, and should it reappear lunar caustic is to be applied.

The term staphyloma has been vaguely applied to many and various tumours of the cornea. It has been called total when the whole cornea is morbidly prominent, and partial when the tumour is confined to a portion only. For some very interesting remarks on this subject the reader is referred to Wardrop, and Scarpa.

Since the first edition of the Elements of Surgery, some very important improvements have been made in the treatment of cataract, which I shall next relate, having judged it proper to leave my previous account of extraction and couching for the information of those readers who may not have access to other works on these subjects.

Mr. Saunders's operation of lacerating the capsule and destroying the texture of the lens, by means of a double-edged needle introduced through the cornea or sclerotica, which succeeds so happily in cases of congenital cataract, has been found also well adapted to a large number of cataracts occurring in advanced life. I have myself employed it in a great many cases with complete success, and the facility with which it is performed, together with the little injury which the eye sustains from it, give it certainly strong claims to a preference over either couching or the former methods of extraction. When I adopted this mode of treatment, I commenced a journal of my operations and recorded the results of eighteen cases, which were published in the second American edition of Cooper's Surgical Dictionary, in 1816, viz: between the 25th of April, 1814, and the 25th of October, 1815, I performed Mr. Saunders's operation as improved by Mr. (now sir William) Adams, in eighteen cases; at the time of the publication alluded to, eight of the patients were completely cured; in two of the cases both eyes were cured, in the others only one;—two of the patients refused to wait for absorption, and were cured by extraction;—in two permanent blindness ensued from violent inflammation, and the remaining six were under treatment. These have since been operated on repeatedly, and have all got well, with one exception; in that case, making the third out of eighteen, inflammation destroyed the eye.

I have continued to employ this operation, sometimes passing the needle through the cornea and sometimes through the sclerotica in a much greater number of cases, but of these I have not preserved an entire list: my success, however, has been such as induces me to declare a decided opinion that it is far preferable to the usual mode of extraction, or to couching. It has succeeded, partially or totally, in a great majority of cases, since the publication alluded to, but by no means so generally as in sir William Adams's practice; in some it has proved exceedingly tedious, and my patients, in one or two instances, have been twelve months and longer before absorption has been completed. The gradual improvement of vision, however, satisfies them and eventually success appears as certain as from any other operation. I have now I believe, operated upon nearly fifty cases, and in six of these the eye has been destroyed by inflammation. In one of these instances the patient was very old, the cataract fluid, and immediately on its escaping from the wounded capsule into the anterior chamber and mixing with the aqueous humour, he complained of severe pain—this continued and augmented, and although the operation was performed with as little violence to the eye as possible, suppuration took place. I cannot but ascribe this result to some irritating quality of the fluid lens. In a few other cases in which the operation has been very cautiously performed, violent inflammation has resulted, but has been cured by copious evacuations.

Sir William Adams has just favoured the world with his anxiously expected volume on cataract, and his success in treating it seems to exceed any thing which the most sanguine hopes could have anticipated. Of thirty-one cases of cataract, at Greenwich hospital, many of which were complicated with other diseases of the eye, he completely cured twenty-nine; one only failed, and one was dismissed for irregular conduct.* The testimonials of accuracy in this statement are from the governors of the hospital, noblemen and gentlemen of great respectability, and are entitled to the fullest confidence. The treatment of sir William Adams varies in different cases. I shall proceed to give an outline of his practice.

"I shall commence with the description and consideration of the operation for "solid cataract in children and in adults." It is an operation, perhaps, more extensively applicable, and which has proved more generally successful, than any other, either ancient or modern.

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* If this be contrasted with the results of the practice at the Hotel Dieu at Paris, it will be found that the improvements are very striking. In that celebrated institution one hundred and thirteen cases were operated on from 1806 to 1810—and of these only forty-three were completely successful, and ten partially so. And in the very hospital in which Sir William Adams operated, of twenty-four cases in which extraction was performed by the usual method, *one* only succeeded.

Having secured the eye by making a gentle pressure with the concave speculum, introduced under the upper eye-lid, I pass the two-edged needle through the sclerotic coat, about a line behind the iris, with the flat surface parallel to that membrane; it is then carried cautiously through the posterior chamber, without in the slightest degree interfering with the cataract or its capsule. When the point has reached the temporal margin of the pupil, I direct it into the anterior chamber, and carry it on as far as the nasal margin of the pupil, in a line with the transverse diameter of the chrystalline lens. I then turn the edge backwards, and with one stroke of the instrument, cut in halves both the capsule and cataract. By repeated cuts in different directions, the opaque lens and its capsule, are divided in many pieces, and at the same time I take particular care, to detach as much of the capsule as possible from its ciliary connexion. As soon as this is accomplished, I turn the instrument in the same direction as when it entered the eye, and, with its flat surface, bring forward into the anterior chamber, as many of the fragments as I am able: by these means, the upper part of the pupil is frequently left perfectly free from opacity. By cutting in pieces the capsule and lens at the same time, not only is capsular cataract generally prevented, but the capsule is also much more easily divided into minute portions, than when its contents have been previously removed.

The needle which I employ in this operation, is eight tenths of an inch long, the thirtieth part of an inch broad, and has a slight degree of convexity through its whole blade, in order to give it sufficient strength to penetrate the coats of the eye without bending. It is spear-pointed, with both edges made as sharp as possible, to the extent of four-tenths of an inch. Above the cutting part, it gradually thickens, so as to prevent the escape of the vitreous humour.*

This instrument, it is apparent, is well calculated to cut in pieces with facility, any cataract whose nucleus is not too solid to admit of division, and from the peculiar manner in which it is employed, (by making the vitreous humour and the attachment of the capsule to the ciliary processes, a counter-resistance to the cataract, while acted upon with its edge turned backwards,) is capable of dividing the nuclei of lenses of a greater degree of solidity, than could be effected by any other instrument hitherto used for the same purpose. Most of these instruments are sharpened, a short way only from their point, and any attempt to divide with them a lens of any considerable degree of solidity, would, instead of accomplishing the division, detach the lens from the ciliary processes, when, according to the usual practice, no alternative remains but either to depress the lens in the vitreous humour, or to place it in the anterior chamber for solution and absorption, whole and undivided, which latter practice can never be done with safety, when its nucleus does not admit of division.

The first step of this operation consists in carrying the needle through the coats of the eye, which, from its spear point and sharp edges, can be effected with a very slight degree of force, as it penetrates the dense sclerotic with as much facility as a lancet, while, from its very small size, it inflicts as little injury upon the organ as it is possible for any instrument to do. There is reason to believe, that the degree of force which is necessary to be used, in effecting this step with a needle whose blade is round, instead of being flat, is one source of the inflammation which immediately succeeds to the operation, while the wound inflicted upon the coats of the eye, partaking more of a contused than an incised wound, is not only another source of irritation and inflammation, but also prevents its healing kindly, which evidently cannot be the case when my sharp-edged needle is employed. It has, however, been stated, that the eye sustains less injury from the use of a blunt than of a sharp-cutting instrument, but this opinion I conceive to be entirely erroneous; where any part is to be divided, it can obviously be done with less injury and violence, the sharper the instrument employed, provided it is used with skill and judgment. If this argument applies to operations in general, how much more forcibly may it be urged, in regard to those on the eye; when any considerable degree of force is there employed, either from the nature of the operation itself, or from the instrument with which it is executed, a degree of inflammation is produced, which too often baffles the utmost skill of the operator. On this account, it is observable, that the most experienced oculists are the most particular in their instructions relative to the form and condition of their instruments, all agreeing, that the favourable termination of the section of the cornea, greatly depends upon the good condition of the knife; and surely, if it is the principle of an operation to divide the cataract, that object can be more expeditiously accomplished, and with less violence to the eye, with a sharp-cutting needle, than with a blunt one, in which latter case, the cataract is torn, rather than cut; so many movements of the needle are also required, as not only to prolong the sufferings of the patient, but the continued action of the instrument upon that part of the coats of the eye in which it is inserted, necessarily excites inflammation, and hazards the total failure of the operation.

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* An engraving is unnecessary from its resemblance to Saunders' needle.

From the facility with which my needle penetrates the coats of the eye, the operator (particularly if he has been in the habit of employing needles with round blades) should be careful not to use much pressure, and should make the puncture at a sufficient distance behind the iris, and parallel with its plane surface, otherwise the point may either pass through that membrane before it reaches the edge of the pupil, or be carried too far into the eye towards the nose. In either case, however, no serious mischief is to be apprehended, and these accidents can only occur to a very inexperienced and unsteady operator, who would probably do much more mischief to the eye, by any other mode of operating; the eye being rendered immoveable by the speculum, and the pupil previously dilated by the belladonna, the iris is the only part at all likely to be injured in this step of the operation, unless indeed the instrument be broken in penetrating the coats of the eye, an accident which, when the operation is performed, agreeably to the description of it given at length in my work on Diseases of the Eye, can only happen from unskilfulness.

The second step of the operation consists in dividing both capsule and lens, with the same stroke of the knife. This may be always accomplished, when the vitreous humour is in a healthy state, in young, and frequently in old persons, by turning the edge of the knife backwards, in the manner directed, provided the usual degree of firmness, in the attachment of the capsule to the ciliary processes, exists. In those cases, however, where the nucleus of the lens is too solid to admit of division, if an attempt is made immediately to divide the lens, it will be entirely separated from its natural adhesions, when, should the vitreous humour be partly or wholly disorganized, the cataract will immediately become spontaneously depressed, when it cannot be extracted, without hazarding a very dangerous escape of the vitreous fluid. This is the only accident to which the second step of the operation is liable, when properly conducted; as, if the iris be wounded with the point of the needle, it must, as in the first, at all times be the fault of the operator. Should he not have had sufficient experience to enable him to ascertain with precision, the nature of the cataract by previous examination, he may certainly fall into the error, of attempting to divide a lens, which is too solid to admit of such division, when, should the vitreous humour prove to be in a disorganized state, he necessarily subjects the patient, to the dangers already detailed, from the depression of a solid lens, in a fluid vitreous humour. As this knowledge can only be acquired by practice, and observation, the young operator, in all doubtful cases, should proceed with caution; and, instead of attempting to cut the capsule, and cataract in halves, with one stroke of the instrument, it will be prudent in him, to act at the first only with its point; by this means, he will be enabled, to ascertain the consistence of the opaque lens, which will direct him how to proceed, in the prosecution of this, the most important step of the operation.

Having effected the division of the nucleus of the cataract, the operator is then to remove the divided portions with the point of the needle, through the aperture of the pupil, into the anterior chamber, which constitutes the third, and last step of the operation.

When the consistence of the cataract is tolerably firm, there is no difficulty in placing a part, or even the whole of the divided lens in the anterior chamber, should it be adviseable so to do, such is the dilated state of the pupil; no impediment is presented to the accomplishing that object; but when, as sometimes happens, the lens is very soft, and of a jelly-like consistence, the flat part of the needle, passes through it, with as much facility, as if it were turned edgeways, in which case, after freely dividing the capsule, as well as the lens, it will be better, to avoid irritating the coats of the eye considerably, by repeated attempts to pass the portions of cataract through the pupil, which might probably produce inflammation, but rather to let it remain in situ, (taking care, however, to prevent its pressing too much against the posterior part of the iris,) where it will in a few weeks become lessened in quantity, and acquire a consistence which admits of its being removed with great readiness into the anterior chamber, if it be necessary to repeat the operation. In this stage, also, the iris may be wounded with the point of the needle, from a want of dexterity in the operator, but otherwise that accident will never happen, as, from the dilated state of the pupil, its circular margin is sufficiently out of the way of the needle, when the operation is skilfully performed.

If the capsule be partially, and not completely cut in pieces, during the division of the lens, after placing the fragments of that body in the anterior chamber, the capsule should be lacerated to the full extent of the area of the pupil. In doing this, the iris is alone the part subjected to injury; whatever injury the ciliary processes, or vitreous humour, have sustained during the posterior operation, (as the introduction of the needle behind the iris has been called,) being of no moment whatever, the uses of the ciliary processes having ceased, as soon as the chrystalline lens is removed; and it is evident, from the very little irritation generally excited in the eye by the operation for capsular cataract, that no inflammation is to be apprehended from the laceration of these processes by the needle; experience in the operation for couching, (but especially the circumstance of the patient's vision not being perceptibly impaired, when the vitreous humour is in part or wholly disorganized,) renders it equally certain, that no injury is occasioned by the needle having lacerated the vitreous tunic.

The next operation to be considered is that for "*capsular* and *adherent capsular* cataract." The needle used in this operation, although slightly curved, is much less bent at its point, than that recommended by Professor Scarpa, on which account the surgeon can direct the point of it with greater ease and precision, for the purpose of separating minute portions of capsule, when adherent to the iris. In this operation the capsule should be lacerated very freely, as much as its consistence will possibly admit of; but when that membrane is too thickened to enable the operator to accomplish this object, he must then detach it, from its ciliary connexion, except at one small part, as I have already described, and afterwards place it out of the axis of vision. In effecting these steps, there is less likelihood of wounding the iris even than in the operation for children and young persons, from the point of the needle, which is introduced at the same distance behind the iris, being somewhat curved, and directed towards the bottom of the eye, the pupil being dilated by the belladonna.

When the capsule adheres to the iris, constituting "*adherent capsular* cataract," the operator must proceed more cautiously, otherwise, in liberating the adhesions between the cataract and the iris, the latter membrane may be injured, and thereby give rise to severe inflammation; or, should the adhesions be very firm and extensive, a forcible attempt at separation would be likely to detach the iris from the ciliary ligament, and consequently occasion an obliteration of the natural pupil. In this, as in the operation for capsular cataract without adhesions, care must be taken not entirely to detach the capsule from the ciliary processes, as it would float about in the vitreous humour, and probably obstruct the pupil; but, on the other hand, if not sufficiently detached, it will be likely, particularly if much thickened, to rise again into its former situation. Should these accidents occur, the evils resulting from them may be avoided; the floating portions may be extracted through a small puncture in the cornea, and if the capsule should rise, the operator may again introduce the needle through the same puncture in the eye, and detach it still further; or, if the return should not take place for some time after the operation, it may be again repeated, and the further detachment effected, as may be necessary.

In "*adherent lenticular cataract,*" when the pupil is not too much contracted, provided the nucleus of the lens is sufficiently soft to admit of division, I employ the same two-edged needle as in operating for the solid cataract in young persons. Part of the fragments should then be carried through the pupil with the point of the needle into the anterior chamber for solution and absorption. In this case, great caution is necessary on the part of the operator, both from the small size of the pupil, and from the extensive adhesion of the capsule of the lens to the iris, affording a much smaller area for the action of the needle, and thereby rendering the iris more liable to be cut or punctured with the point of the instrument, while dividing the lens; in effecting this division, unless the surgeon proceed with similar caution, the iris is put so much upon the stretch as either to hazard its partial detachment from the ciliary ligament, or to produce a considerable degree of inflammation. By proper care and delicacy in the use of the needle, these dangers may, however, be wholly avoided, and are to be apprehended only, when an injudicious degree of force is employed with the instrument. If the pupil be too much contracted for the purposes of vision, the surgeon, instead of using the two-edged needle to cut up the cataract, should, at the first, proceed to the division of the iris, in order to form an artificial pupil, in a manner which will presently, be minutely described.

When the lens is hard and solid, and the pupil sufficiently large to admit of its free passage, I at once carry the lens forwards into the anterior chamber, with the two-edged needle, ready for extraction, but more commonly the pupil requires enlargement before this can be effected. The iris scalpel, should in this case be employed at first, with which the iris should be divided transversely full two-thirds of its extent, and the lens afterwards carried through this new opening, into the anterior chamber, with the point of the same instrument. Should the lens be soft, and even transparent, both lens and capsule ought to be cut through and divided, the capsule being always opaque, which would intercept the rays of light, equally as if the lens were in the same state.

In introducing the iris scalpel at the usual distance behind the iris, its edge should at the first be turned backwards instead of upwards or downwards; by that means, the stretching of the aperture in the coats of the eye, which ensues from subsequently turning its edge backwards, (as is recommended in the operation for solid cataract in young persons,) and also the escape of a portion of the vitreous humour, when partially or wholly disorganized, will be prevented. It is of great importance that this escape should not take place in this particular species of case, for the coats of the eye being thereby rendered flaccid, a sufficient resistance to the action of the knife is not afforded in dividing the iris; whereas, if the operator endeavours to accomplish his object by increasing the degree of pressure upon the instrument, he will detach that membrane from its ciliary ligament, instead of dividing it. It is necessary not only to divide the iris, but either to detach, or divide the capsule of the lens, to the full extent of the opening of the iris, otherwise its radiated fibres cannot retract the edges of the divided membrane sufficiently distant from each other, to prevent their reunion by the first intention, unless indeed some portions of the fragments of the divided lens are interposed between them.

For the purpose of dividing the iris, I introduce the point of the instrument, through the coats of the eye, about a line behind that membrane. The point is next brought forward through the iris, somewhat more than a line from its temporal ciliary attachment, and cautiously carried through the anterior chamber, until it nearly reaches the inner edge of that membrane, when it should be drawn nearly out of the eye, making gentle pressure with the curved part of the cutting edge of the instrument, against the iris in a line with its transverse diameter. If, in the first attempt, the division of the fibres of the iris is not sufficiently extensive, the point of the knife is to be again carried forward, and similarly withdrawn, until the incision is of a proper length. I take care, however, very freely at the same time to cut the cataract in pieces. Some of these pieces I bring into the anterior chamber, and leave the remaining portions in the newly-formed opening of the iris. These act as a plug in preventing its reunion by the first intention, and assist the radiated fibres, in keeping the pupil more extensively open; by the time these fragments are dissolved, the iris has lost all disposition, or indeed power, of again contracting, its divided edges having by that time become callous, and being drawn considerably apart by the permanent contraction of the radiated fibres." (ADAMS.)

In reviewing the innovations introduced within a few years in the treatment of cataract, every intelligent surgeon will perceive, that they embrace modifications of every mode of operating hitherto employed, and are to be regarded more in the light of improvements than inventions, nor is this conclusion derogatory to the characters of those by whom these new modes of operating have been introduced—*Since his merit is surely greatest, whose practice succeeds best.* Mr. Hey has a sentence which I shall here transcribe, as proving that before Mr. Saunders or sir William Adams were known in the medical profession, he had accidentally performed their operations.

"Though I do not think it advisable to persist in pressing an entire cataract into the anterior chamber, when the advance of the cataract causes a large dilatation of the pupil; yet after the needle has wounded the capsule, a firm cataract, or at least its nucleus, will sometimes slip through the pupil without the design of the operator. This has been considered by some authors, as a disagreeable circumstance, and has been ranked amongst the objections to the operation of couching. *On the contrary, it ought to be considered as a favourable event, since the cataract always dissolves in the aqueous humour, and finally disappears without any injury to the eye.* This, at least, has been the event in every case of the kind which I have seen. I have six or seven times seen the whole opaque nucleus fall into the anterior chamber of the eye, and very frequently small opaque portions. *Indeed, if the cataract could, in all cases, be brought into the anterior chamber of the eye, without injury to the iris, it would be the best method of performing the operation.* But this is not usually practicable; the softness, as well as the bulk of the cataract presenting an obstacle to this process."

It is strange that Mr. Hey should state, that when the nucleus of a cataract accidentally escapes into the aqueous humour it is a favourable circumstance, and should yet never have done by design what succeeded so well by accident.

Sir William Adams's new mode of extraction I have too recently been acquainted with to decide upon it. I think it well entitled to trial, and shall try it impartially.

One remark I shall make in concluding this article, which is, that it is impossible to anticipate the degree of inflammation likely to result from any operation on the eye. In some cases when merely punctured, it inflames very violently, and in others, where the operation is difficult and protracted, scarcely any inflammation results. This remark must not be construed into an apology for violence, or for too much effort to destroy the texture of the lens, for I believe that the surgeon who treats the organ most tenderly will be most sure of success.

My own practice at present is to destroy as much as possible the texture of the lens and capsule in the manner described by sir William Adams, and with the same instruments, and to push the fragments as much as possible into the anterior chamber for solution and absorption. When the nucleus remains unabsorbed and very hard, I propose in future to extract it. I have in two cases found long continued inflammation to result from leaving a large portion of hard cataract in the anterior chamber; these portions are diminishing however daily, and I trust will be ultimately removed. Some of my patients with very tough membranous cataracts, have as yet, derived no benefit from the operation, and are still under treatment. I have a gouty patient thus circumstanced, whose eye occasionally inflames severely during his gouty paroxysms.

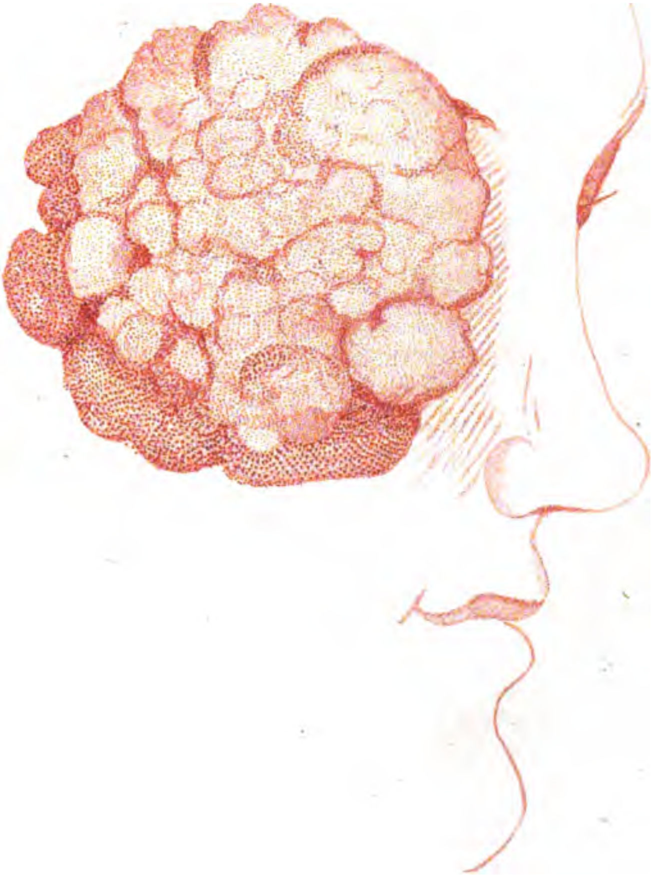
CHAPTER LX.

Extirpation of the Eye.

This operation, terrible in its nature, is extremely simple. The diseases which render it necessary are not very accurately defined. In general it is performed for the removal of a disorganization which commences, and terminates in a fungous tumour: in some cases this affection begins without pain, but commonly it is preceded by head-ache, and itching and watering of the eye. It is in some cases truly cancerous, but in others, probably, has no cancerous tendency. It occurs at all ages, but oftenest in young persons. More than one-third of Desault's patients were under twelve years of age. As the disease advances great pain is perceived—sight is lost—the cornea inflames, ulcerates, and bursts—a fungous red tumour projects through it, discharging a purulent sanies, fetid and acrid—the size of the tumour becomes very great. I extirpated a fungous tumour of this nature from the socket of a boy's eye, resembling, except in colour, a cauliflower, its size and appearance are represented in the annexed plate—no return of the disease took place. The plate affords a tolerable idea of the general form of this dreadful malady.

The operation is to be performed, when practicable, by separating the lid, from the ball of the eye with a scalpel: but in many cases this is impracticable, and all that can be done is to save as much of the upper lid as possible, provided it be sound. A straight bistoury of sufficient strength is to be passed as quickly as possible round the basis of the tumour, the surgeon making it revolve upon its point in such a manner as to keep the

PLATE XII.



Carcinoma of the Eye

J. S. Dorsey del. & Sculp.

edge close to the bony orbit. Having seen Mr. Dubois at Paris perform the operation in this simple manner, I have imitated his example, and in a very short time the operation is completed. Any portions of the tumour which remain may be afterwards removed, but as the hemorrhagy is always very profuse, whatever cutting is done, should be done quickly. The orbit is to be filled with lint, and the bleeding soon ceases. The antiphlogistic regimen should be adhered to for a few days.

Sometimes the fungus returns, and although often destroyed, as frequently springs up. In these cases the event is fatal. But as death is inevitable if the disease be not extirpated, the attempt ought always to be made. I have four times performed the operation, and three of the four patients remain quite free from disease. The fourth was attended with disease of the absorbent glands, and terminated fatally, though life appeared to be prolonged by the operation.

TAPPING THE EYE.

Dropsy of the eye, or HYDROPHTHALMY, sometimes renders it necessary to evacuate the aqueous humour, accumulated in too great quantity. Scarpa states that in the cases of dropsy of the eye which he has dissected, the vitreous humour has been in a morbid state of fluidity, and he was unable to distinguish it from the aqueous humour. The proper internal remedies having been in vain administered, if the eye-ball continue to augment in volume, and protrude from the socket, it becomes necessary to open the eye by a surgical operation. Nuck used to puncture the centre of the cornea with a small trochar; other writers recommend the puncture to be made through the sclerotica. Scarpa advises a small circular incision to be made in the upper part or centre of the cornea, as the best mode of evacuating the eye. In several cases I have punctured the cornea by inserting the point of a sharp cataract knife through it, the evacuation of the aqueous humour although not sudden, was amply sufficient, but if necessary it is very easy to turn the knife a little, so as to make the incision somewhat circular, whereby the fluid will more readily escape.

Dr. Physick from an idea that gutta serena is in some cases occasioned by pressure upon the retina and optic nerve from an over secretion of aqueous humour, has punctured the eye with a view to relieve this affection. In some instances the operation has been evidently advantageous—in others no benefit whatever has resulted. I have suggested this because I shall not enter into the history of this paralytic affection of the eye, as many excellent histories of it are in the hands of every medical man. Richter, Scarpa, and Ware are among the best writers on the subject, and to them I refer, only suggesting that in very obstinate cases where other remedies have failed, tapping may be tried, as it has been sometimes useful, and the repeated application of blisters directly over the eye-lids, are also occasionally beneficial.

PLATE XIII.

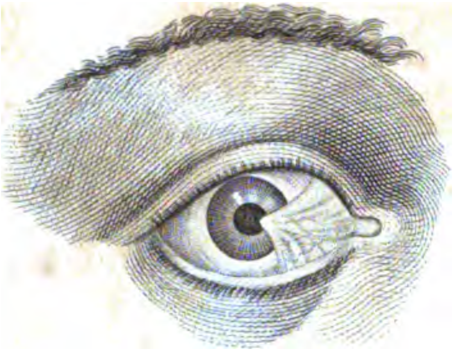


Fig. 1.

Fig. 2.

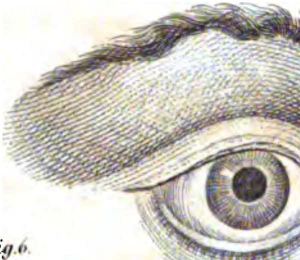


Fig. 3.

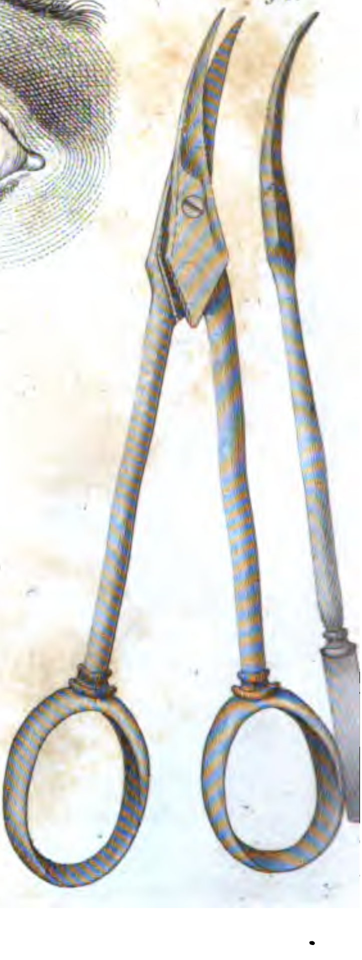


Fig. 7.

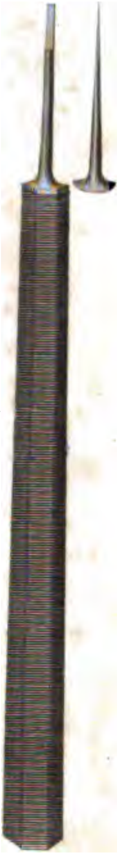


Fig. 6.

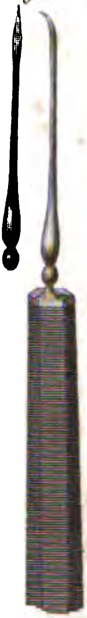


Fig. 5.

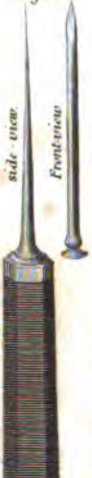
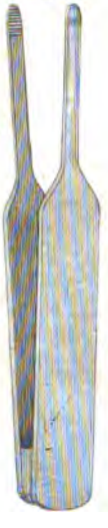


Fig. 4.



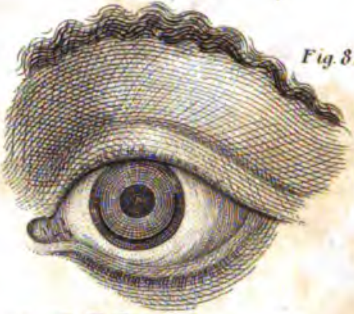


Fig. 8.

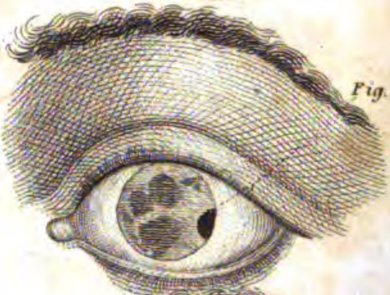


Fig. 9.

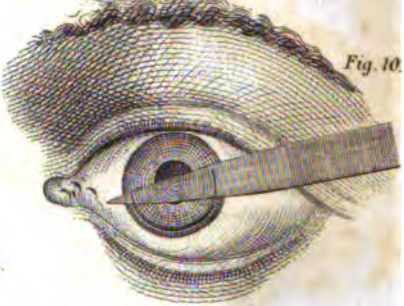


Fig. 10.

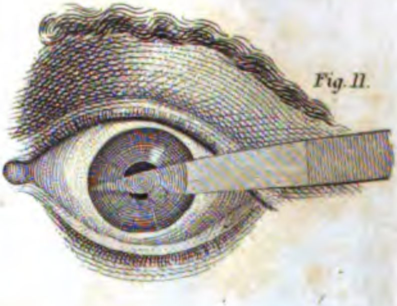


Fig. 11.

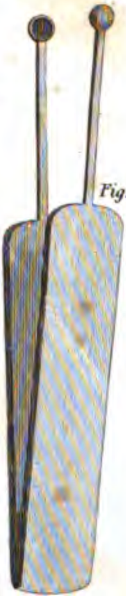


Fig. 12.

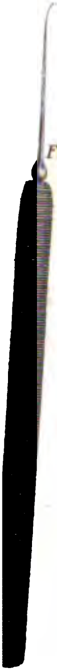


Fig. 13.

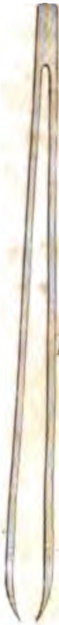


Fig. 16.

Fig. 17.

EXPLANATION OF THE PLATES.

Fig. 1. Represents the most usual form of Pterygium or Unguis.

2. The appearance of an eye, after the excision of that portion of the palpebra, from which the cilia project; an operation performed for the cure of Entropium or Trichiasis.

3. Curved scissors used in various operations on the eye.

4. Forceps.

5. Saunders' couching needle.

6. Scarpa's couching needle.

7. Hey's couching needle.

8. Represents the section made in the cornea in the operation of extracting a cataract.

9. An artificial pupil, near the external margin of the iris.

10. The place of introducing the cornea knife and the mode of passing it through the anterior chamber of the eye.

11. This figure represents an accident which sometimes happens in the operation of Extraction, the floating of the iris before the blade of the knife.

12. The forceps contrived by Dr. Physick, with a circular punch on the extremities of the blades.

13. A small hook useful in the operation of Extraction.

14. Wenzel's knife for incising the cornea.

15. Curette and needle.

16. Wenzel's forceps.

17. The nail-headed style used in fistula lachrymalis.

CHAPTER LXI.

Of Polypus.

A POLYPUS is a fleshy excrescence, of various density and colour, originating from the lining membrane of a canal or cavity, as the nose, vagina, rectum, &c.

The nostrils are the most frequent situation of this complaint. It commences as a small pendulous tumour, void of pain, accompanied with watering of the eyes, sneezing, and the usual symptoms of catarrh. The colour of these tumours is generally a pale red. They commonly commence from the ossa spongiosa; but occasionally from all the parts concerned in forming the cavity of the nostril. They produce at first no other effects than have been noticed, but as they enlarge, the defluxion from the eyes increases, sneezing is frequent, and the tone of voice is much altered. The weather has a great influence on the patient. In dry weather the tumour appears to diminish, and it increases in damp and cold weather—augmenting gradually in size, it at length obstructs the passage of air through the nostril and in this stage produces a very unpleasant nasal tone of voice. The polypus assumes gradually the shape of the cavity of the nose, being formed in it as in a mould. It becomes visible at the anterior nostril and at the fauces behind, where it may be seen situated over the soft palate, and sometimes hanging down behind the uvula. In this state great inconvenience is experienced—the eyes are constantly suffused with tears, from the obstruction to the ductus ad nasum. In some instances, ulceration takes place, and a fetid matter is discharged, attended with great inflammation and severe pain. In some cases, however, it is remarkable that the tumour acquires a great size and the patient suffers no pain. From the nose being stopped patients generally sleep with the mouth open, and inconvenience is sustained from the dryness of the mouth and throat. Hearing is often injured, probably from pressure against the Eustachian tube. In swallowing, some difficulty is experienced from the weight of the tumour which presses against the velum pendulum palati. The appearance of the face becomes changed from one nostril being wider than the other, the root of the nose appears swelled, and violent head-aches come on—the bones eventually become carious and ulcerated—a foul fetid sanies mixed with blood is discharged—hemorrhage sometimes ensues—the teeth fall out and a fungus shoots through the sockets. These symptoms in some cases increase and exhaust the patient's strength;—frequent bleedings and an incessant discharge of matter take place, and during the last stage of the disease, stupor and coma come on, and eventually death.—Such are sometimes the dreadful effects of a disease at first trifling, and to all appearance of very little consequence.

The causes of this complaint are not well understood. Some have supposed picking the nose, or violently blowing the nose to have produced it, but for this there is no foundation.

Several species of nasal polypi are described by authors, one of which is said to be of a malignant nature, disposed to end in cancer. This, however, I believe is extremely rare; the most common are a fleshy, red vascular polypus, and a pale tough, firm polypus, neither of which is of a cancerous nature.

TREATMENT.

The cure of polypi consists in extracting or destroying them with caustic.

The extraction may be performed by forceps, or by passing a ligature round the base of the tumour in such a manner as to destroy the circulation, after which the polypus soon falls off. The application of a ligature is to be preferred in cases where the pedicle by which it hangs is very small, or in cases where the patient is too feeble to bear the loss of blood which is apt to follow the use of the forceps. The mode of applying the ligature must vary in different cases. Sometimes all that is necessary is to pull the polypus forward with a hook and pass a silver wire over it—or a waxed ligature may be formed into a noose and passed round the base of the tumour in the same way. When the wire is to be used a double canula is generally the best instrument for fixing it—it must be drawn very tight, and in a few days the polypus will fall off. It is of great importance to watch when the polypus becomes loose, as it has occasionally separated in the night time and endangered suffocation by falling over the glottis. A case of this complaint occurred several years ago in which Dr. Physick practised a new mode of extraction that will probably be found useful in many other instances. A gentleman having suffered many unsuccessful attempts for the removal of his polypus, came to Philadelphia and consulted Dr. Physick—he found a large tumour projecting behind the soft palate as low as the extremity of the uvula, and filling completely the posterior nares and cavity of the nose, after vain attempts to extract it in the usual manner with ligature and forceps, a piece of tape was made stiff by passing silver wire through it, and this was fixed on the projecting part of the tumour by a firm knot—the tape was now pulled forcibly and with it came away the polypus, which was of prodigious size.

In using the forceps they must be applied as near the root of the polypus as possible. Hemorrhage generally attends the operation but it is not often alarming—cold water or brandy injected into the nose generally checks it. If not, a plug of lint may be introduced into the nostrils so as to press on the part whence the blood issues. If necessary the posterior nostrils may be stopped up by passing a double catgut through the nose into the mouth and by means of this a roll of lint is readily introduced into the posterior nares which invariably succeeds in putting a stop to the hemorrhage.

The application of caustic is often requisite to prevent the growth of the tumour after the greater part of it has been removed. This is in general easily effected by means of a bougie, or a roll of waxed linen in which is included a piece of caustic alkali.

The application may be repeated daily until the tumour no longer grows up.

CHAPTER LXII.

Of Ranula.

THIS consists in a tumour under the tongue containing a glairy fluid, resembling the white of an egg. It is supposed to proceed from an obstruction in the salivary duct. The tumour is generally on one side of the frænum linguæ, and varies greatly in size, sometimes extending to the very point of the tongue, and elevating it considerably.* The tumour sometimes contains instead of the viscid fluid which has been mentioned, a purulent matter, and, sometimes, a calculous concretion. When uninflamed the disease gives no pain, but from its bulk is more or less inconvenient; when it inflames considerable pain is experienced.

TREATMENT.

The remedy for ranula, that is, for a tumour actually formed by a dilatation of the salivary duct, consists if possible in dilating the duct by means of a probe, as recommended by Desault; but it is not often in our power to effect this, and other measures become necessary.

The extirpation of the tumour is difficult and dangerous on account of the large blood-vessels in the vicinity. The British surgeons are in the habit of laying open the cavity of the tumour, by a free incision, after which they apply caustic to its surface. This plan does not always effect a cure, and is unnecessarily severe; a simpler and easier method should therefore have the preference. In a majority of cases the disease may be cured, as recommended by Dr. Physick, by passing a seton through the cavity of the sac; a common curved needle armed with a ligature can readily be passed through the tumour, the needle being cut off, the string is suffered to remain in the cavity of the tumour where it excites inflammation and suppuration, after which a fistulous orifice is established through which the saliva afterwards flows, and this is soon followed by a complete obliteration of the cavity. I have known this simple remedy successful in a great number of cases, and I believe it will be found to fail in very few.

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* I have never seen these tumours very large, but when suppuration takes place in them, large abscesses have been formed, and as much as a pint of matter has been discharged from under the tongue.

If calculous concretions are found in the sac they must be removed, and the caustic if necessary can be applied for the purpose of destroying the sac. I have met with a very difficult case of ranula attended with a large calculous concretion, which occasioned an abscess and salivary fistula in the neck. In this case the calculus enlarged, and was found in close contact with the carotid artery and compressing the œsophagus and trachea. I succeeded in rescuing my patient from his dangerous condition by injecting into the cavity containing the calculus, diluted sulphuric acid, which softened the stone and enabled me to extract it with forceps through an incision made cautiously down to the stone. The aperture of the submaxillary duct being enlarged by probes and bougies, the external wound healed up in a short space of time.

It has occasionally happened that a small calculus in the duct produces the obstruction, in which case all that is necessary is to remove it, after which the tumour will subside.

Mr. B. Bell relates such a case which terminated in ulceration of the cavity. The ulcer could not be healed until the calculus was removed.

CHAPTER LXIII.

Of Salivary Fistulæ.

In consequence of wounds of the cheek or of ulcers, the duct of the parotid gland is sometimes opened and discharges its contents externally. When the patient is eating, the saliva instead of being poured into the mouth, flows out upon the cheek. Whether the loss of this fluid occasions any effect upon the digestive organs or not, the complaint is found extremely inconvenient, two ounces of saliva are said to have flowed out of such a fistula during a single meal.

In case of a recent wound which opens the parotid duct, great care should be taken to unite very accurately the sides of the wound externally; in this way the probability is, that the duct will either reunite or form a fistulous orifice internally, either of which occurrences will prevent the formation of an external fistula.

When the fistula has existed for a considerable time, and attempts have been made by pressure, caustic applications, and other means, to heal up the ulcer without effect, more difficulty is to be anticipated. In these cases it is necessary in the first place to establish an opening into the mouth, and afterwards to heal up the external orifice.

Mr. Charles Bell directs the following measures, which I believe were contrived by the celebrated Dr. Monro: "Our first attempt will be to pass a small silver probe from the mouth into the natural opening of the duct, and enlarge it, if it shall be found contracted; then to substitute a small tube, which being introduced from the mouth shall also pass some way into that part of the duct which discharges the saliva. Lastly, while the tube is retained in its place, the outward lips of the wound are to be made raw, brought together and healed.

" But the circumstances of the case may be such, that it will be better to make a new duct, from the fistulous opening into the mouth. To do this we must push a straight needle, obliquely from the bottom of the fistula into the mouth, and draw through a small seton, which is to be worn until the passage is callous. Then either with or without introducing the tube, we have to endeavour to unite the edges of the outward opening."

Desault made use of the seton in the treatment of salivary fistulæ, but instead of introducing it in the usual manner, he complicated his operation by using a trochar instead of a needle. His mode of cure which differs in several particulars from the one just described, appears to have no advantages over it.

The patient during the cure, should as much as possible avoid speaking, and should be nourished principally upon spoon victuals.

CHAPTER LXIV.

Of Abscess of the Antrum Maxillare.

THIS cavity is sometimes the seat of inflammation and suppuration. The complaint commences like a fit of tooth-ache, a severe darting pain extending through the jaw, without any external tumefaction: afterwards suppuration takes place; the pus flows into the nostril of the affected side, especially when the head is inclined in such a position as to favour its escape. The disease even after suppuration is established is not always easily known, for the mucus of the nostril often resembles pus, and the pus is mistaken for the common secretion of the nostril. In some cases the affection subsides after suppuration takes place, but more generally it continues, and occasions caries of the bone. The absorbents remove portions of bone, and make outlets for the pus in different places. In some cases the sockets of the molar teeth are absorbed, the teeth loosened, and the pus discharged through the openings thus formed into the mouth.

The cause of the disease is often a caries of the upper molar teeth and consequent inflammation of the sockets, extending gradually to the antrum.

The treatment of the abscess is to be commenced by extracting any carious teeth which may exist in its vicinity; this removes in many instances the remote cause of the disease, and also affords not unfrequently a ready outlet for the pus at the most depending part of the abscess, which is an object of great importance. If the fang of the tooth should not extend into the antrum, a perforation is to be made cautiously with the stilette of a small trochar, or a common pointed probe. If, however, the teeth be sound, and pus evidently exists in the antrum, the third or fourth molar tooth should be removed, and an aperture made through its socket into the abscess.

The removal of carious bone should never be attempted before it is quite loose; this process may be very safely trusted to the absorbent vessels.

Besides inflammation and abscess, the antrum is occasionally the seat of fungous tumours. These occasion an enlargement of the bone, and subsequently an absorption of it. The alveolar sockets are protruded downward, and the teeth pushed out from their sockets. The nostril becomes filled up; the excrescence extends in every direction; the eye is pushed upward, and in some cases the skin ulcerates, and the fungus protrudes through it.

The only remedy is an early extirpation of the tumour, by removing a portion of the bone, and dissecting out the tumour with a knife and destroying what may remain with caustic; if the disease have made much progress before the operation is performed, its efficacy is very doubtful. In one case I extirpated a very extensive fungous tumour, extending almost to the orbitar plate of the upper maxillary bone, in a girl, and after a cure was apparently nearly effected, the tumour recommenced its growth and neither the knife nor caustic had any effect in arresting its progress. The disease although not very frequent is extremely formidable, and often terminates fatally.

In the collection of Mr. Heaviside at London, there is a skull exhibiting a very extensive bony excrescence from the antrum and upper jaw, an engraving of which may be seen in Mr. Fox's treatise on teeth. The early extirpation of all such tumours is the only remedy in which confidence can be placed.

CHAPTER LXV.

Diseases of the Tongue.

The frænum linguæ is occasionally too short to allow the free motion of the tongue, and it sometimes extends to the extremity of the tongue and thus confines it. Children suck with great difficulty in these cases, and it becomes necessary to divide the frænum. The operation is extremely easy, and may be performed either with scissors, or, what is better, a sharp pointed bistoury. Care should be taken to avoid the ranina artery.

It is proper to remark that surgeons are often consulted about children, said to be *tongue-tied* in whom there is no confinement of the tongue, a certain difficulty in speaking is generally the reason for the supposition; an inspection of the mouth will readily enable the practitioner to ascertain whether the tongue is preternaturally confined or not.

Ulcers of the tongue arise from various causes and are often very difficult of cure. Sometimes a carious tooth occasions ulceration of the tongue; this ought certainly to be removed or filed smooth. Slits or fissures occasionally form in the tongue which swells and becomes indurated in their vicinity. The use of caustic is generally proper in these cases. Dr. Physick has employed with advantage the actual cautery in a very obstinate case of this kind, with a view to change the nature of the sore into the state of a burn.

Cancer occasionally forms on the tongue;—extirpation is the only remedy; and in performing it, all the diseased parts should be carefully removed. Mr. Home advises in these cases to pass a needle armed with a strong double ligature through the middle of the tongue beyond the diseased part, and to tie one ligature on each side; in this manner the diseased part being deprived of its circulation, will mortify and drop off. The pain is not very great, and no danger of hemorrhagy exists. A salivation in some cases follows, but soon subsides.

It will be obvious to every one that a little attention and dexterity will enable the surgeon to remove such parts only as are diseased, leaving the sound parts of the tongue uninjured; he should always, however, apply the ligature in sound parts. If any circumstance should induce the surgeon to prefer the knife, he should be careful to take up all the bleeding arteries and to have at hand a heated iron in case he should be unable to secure them with ligatures. I particularly urge this precaution upon the young surgeon, because no one unaccustomed to surgical operations upon the mouth can be aware of the difficulty of securing a bleeding artery in these parts.

Ulcers of the tongue are not unfrequently occasioned by diseases of the digestive organs—here the remedies must be internally administered and different cases call for very opposite medicines. In some, alkalies are useful, in others, acids. Opium has relieved a number of these cases. Tartar emetic, in small doses long continued has occasionally succeeded. In addition to these remedies, leeches should be applied in the vicinity of the ulcer, and various astringent lotions are to be tried.

Ulcers from the use of mercury, generally get well when the medicine is discontinued.

CHAPTER LXVI.

Diseases of the Uvula and Tonsils.

INFLAMMATION of the throat and fauces produces sometimes a considerable elongation of the uvula. In general it resumes its usual length after the inflammation subsides, but in some cases it is permanently elongated, and in these instances should be removed;—a hook may be inserted into the uvula to prevent its slipping backwards, and then with a pair of scissors a portion of it can be easily cut off. There is no danger of hemorrhagy.

The tonsils in this climate are particularly liable to inflammation. In some cases the swelling is very considerable and breathing and deglutition are greatly impeded. In these cases, in addition to the remedies employed by the physician, scarifications become necessary. A sharp scalpel answers the purpose very well. A number of small incisions are to be made, and the vessels suffered to unload themselves; the mouth and throat should be rinsed with warm water to promote bleeding. In case of suppuration the abscess may be opened by a common lancet, and great relief will be immediately perceived. A particular instrument has been constructed for the purpose of opening abscesses of the throat, called pharyngotomus, an engraving of which may be seen in Brambilla's Instrumentarium. It has no advantage over a common lancet or scalpel.

The tonsils are sometimes enlarged and indurated from successive inflammations, and sometimes an enlargement occurs without any evident cause. The complaint is usually, but improperly, denominated schirrhus.

It has no disposition to terminate in cancer, but great inconvenience is experienced from the bulk of the tumour. A part or the whole of the tonsil may be removed by means of a knife, but in this operation the bleeding is sometimes troublesome. Caustic may also be employed, but it is the most tedious and painful mode of removing the glands. The application of a ligature around its base, is I believe the safest and best mode of extirpating schirrhus tonsils; at least I have never seen any inconvenience from this method, and I have seen it very frequently performed.

When the base of the tumour is small, a silver wire in a double canula, is to be applied round it, in the same manner as around the root of a polypus; this wire is to be drawn very tight and secured to the shoulders of the instrument. In a great majority of cases this operation is very readily performed, and in a few days the tumour drops off. Great care is necessary to make the ligature sufficiently tight in order to prevent all circulation in the tumour, otherwise a portion of it only will be destroyed, the central part remaining after the rest had dropped off.

When the base of the tumour is large, it is best to cut off at least a considerable portion of the gland with a bistoury; the bleeding may in general be restrained by washing the mouth with cold water. If the whole of the tonsil be removed with the knife, it is said that a great discharge of blood takes place. I believe that no dangerous hemorrhagy would be likely to occur, for if the bleeding vessels did not speedily contract, it would be easy to apply a hot iron and put a check to the discharge. The great improvements of modern surgery have almost entirely banished the actual cautery from practice, but in certain hemorrhages from the fauces, it is indispensable.

CHAPTER LXVII.

Of Foreign bodies in the Œsophagus.

Substances occasionally become arrested in the œsophagus, and by pressing forwards the membranous part of the trachea obstruct respiration. I believe with Mr. Charles Bell, that the obstruction in these cases is not purely of a mechanical nature, but that spasm is excited by the irritation produced, and the muscles of the glottis diminish very much the aperture through which the air passes.

If the substance be not likely to occasion unpleasant consequences in the stomach, it is generally easier to push it down than to extract it through the mouth—pins, needles, sharp bones, or any pointed substance which would probably wound the œsophagus, or any portion of the alimentary canal, and also substances which from their chemical qualities would be likely to occasion mischief, as copper coins, &c. should if possible be extracted through the mouth. This can only be done when they are situated high up near the fauces. If near the stomach they must be pushed down, and the risk of the consequences must be incurred.

To extract substances from the œsophagus the fingers and forceps are generally the only instruments which can be employed, and we are very often able to see the foreign body by pressing down the tongue with a spoon; even when the sensations of the patient lead him to suppose that it has descended very low; a hook of curved wire is also useful in some cases for extracting foreign matters, especially when they are of considerable size. In two instances I have known the spasm which had arrested a foreign substance, speedily relaxed by a solution of emetic tartar. In each of these cases, a large peach stone had slipped into the œsophagus, and the patients were of course unable to swallow, and could not breathe without great difficulty. They were directed by Dr. Physick to hold in their mouths a solution of emetic tartar, and attempt to swallow it. Nausea came on, and the spasm relaxing, the peach stones were readily discharged.

An ingenious mode of extracting small substances, as needles, fish-bones, &c. is described by Mr. S. Cooper. "The art of employing compressed sponge in the most advantageous manner, consists in taking a piece about the size of a chesnut, and introducing each end of a strong ligature through it. The ends of the ligature are then to be passed through a tube, and fastened to that end of the instrument which the surgeon holds. The sponge is then to be introduced down the œsophagus beyond the foreign body, and water is to be injected through the tube, in order to moisten the sponge and make it expand. After this the ends of the ligature are to be firmly drawn, for the purpose of pressing the sponge against the extremity of the canula to make it expand still more. Then the tube is to be withdrawn, together with the sponge, observing to twist the instrument to the right and left in this part of the operation.

"When the foreign substance cannot be extracted with this instrument a probang may be tried, to the end of which a bunch of thread, doubled so as to make an immense number of nooses, is fastened. Little bodies may frequently become entangled, and be extracted in this way, when the other one fails."

When the foreign matter cannot be extracted, it becomes necessary to push it forcibly into the stomach, this is generally done by means of a probang, a piece of sponge tied on the end of a whalebone, or large firm bougie of waxed linen. In many cases where much inconvenience has been anticipated from the nature of the foreign substance, it has passed through the alimentary canal, without occasioning any great inconvenience. I have known, however, a very extensive fistula in ano, produced by a large fragment of bone accidentally swallowed.

When the foreign body cannot be either extracted or pushed down into the stomach, it sometimes occasions very speedy suffocation. Benjamin Bell relates two cases of death from this cause, and Desault mentions one instance in which a woman swallowed a bone with so much voracity that it lodged in the middle of the pharynx and occasioned suffocation; she died in three minutes: numerous accidents of a like nature have happened.

In other instances the foreign matter remains for many years, occasioning no inconvenience. A boy four years old, playing with an English farthing, slipped it into the œsophagus and was unable to swallow or eject it. The accident happened in Dublin; Dr. Dease and several other surgeons of eminence attempted to extract it, but without success; the immediate symptoms of suffocation soon subsided, and the coin, although very inconvenient to the patient in his attempts to swallow, remained without occasioning any very alarming symptoms. He came to America, and was attacked in this city with a vomiting of blood of which he died after a few hours illness, at the age of seventeen years. Upon examination after death, I found the coin lodged vertically in the œsophagus opposite the bifurcation of the trachea, it was so loose as easily to move upwards, its motion downwards was more difficult. The copper was encrusted with a thick coat of dark greenish matter, which was detached at one part shewing the metallic surface. How it was detained thirteen years in this situation I am at a loss to imagine; certainly it would have been an easy matter to have pushed it into the stomach, and by no means impracticable to have withdrawn it through the mouth.

Sometimes pins and needles are swallowed, they occasion abscesses by sticking in the œsophagus, when they get into the stomach they are generally evacuated with the fæces. In other instances they travel to different parts of the body, and ultimately approach the surface. A case is related in the Memoirs of the Academy of Surgery, in which a needle remained eighteen years before it made its appearance externally, during which time very little sensation was occasioned by it.

The operation of cutting into the œsophagus in order to extract foreign bodies, I have never known necessary, and I believe it ought very seldom to be done. The memoirs of the French Academy contain, however, two cases in which it was successfully performed.

Whenever suffocation is dreaded, and the patient is unable to breathe in consequence of a foreign body in the œsophagus, it becomes necessary to maintain the communication of air to the lungs, by artificial means hereafter to be described. By these means we have it in our power to prevent suffocation, and thus to afford time for the removal of the foreign body.

CHAPTER LXVIII.

Of Strictures of the Œsophagus.

The œsophagus being a muscular canal is capable of contracting at times and of being again dilated. Occasionally spasm takes place at a particular part of the œsophagus and produces a spasmodic stricture, similar to the same disease in the urethra. Permanent strictures in the œsophagus also occur, producing a narrowness at the part, with thickening of its substance, and at length if not prevented, an almost total obliteration of the canal. The case in this way proves fatal by cutting off supplies of food, from the stomach, unless medical aid is successful in relieving it.

The disease can in no manner be better explained, than by a history of cases in which it has occurred. Mr. Home has published several in his second volume on strictures to which the reader is referred. The complaint generally commences with a difficulty of deglutition, gradually increasing until fluids only can be swallowed, and at last every attempt at deglutition becomes extremely painful and attended with a sense of suffocation, from the substance passing into the glottis. Emaciation takes place—hunger is extreme, and the patient unless relieved, is literally starved to death. I have seen one case in which this actually happened—upon dissection the œsophagus was found so nearly obliterated that a probe could not without difficulty be forced through the stricture.

The treatment recommended by Mr. Home is to dilate the stricture by introducing bougies of waxed linen, commencing with such as readily enter it and gradually enlarging their diameter so as to dilate it. In some cases this method is ineffectual, and the progress made in dilating the passage is too slow. Mr. Home has employed the caustic in such instances with advantage, and Dr. Andrews of Madeira, has lately published some cases in which the same remedy proved successful. The lunar caustic is to be preferred. It must be fastened securely in the extremity of a bougie, of such a size as to pass readily down to the stricture; another bougie of a larger diameter is first to be introduced, and when the resistance of the stricture is felt the patient by shutting his mouth makes a mark with his teeth, upon the instrument, by which the precise distance of the stricture is ascertained. This bougie being withdrawn, a mark corresponding to it, is to be made on the bougie, armed with caustic, which is next to be introduced, and suffered to remain half a minute in contact with the stricture; this may be repeated as often as necessary. In passing the bougie, it will be an advantage to preserve as accurately as possible the curve which the first instrument had assumed, as this facilitates greatly the operation of introducing it.

CHAPTER LXIX.

Of Obstructions in the Glottis and Trachea.

Whenever respiration becomes interrupted in consequence of obstruction in the trachea either from disease, or from foreign substances accidentally introduced into it, it becomes necessary to make an artificial opening into this canal, below the obstructed part, in order to preserve the free communication of air to the lungs. This has generally been done by cutting into the trachea, an operation which may be performed with great safety and without risk of any permanent inconvenience—this truth is established, not only by the frequency with which the operation has been performed, but also by the facility with which even the most extensive wounds of the windpipe heal up, after unsuccessful attempts to commit suicide.

Although the operation of cutting into the trachea may become necessary in a variety of instances, yet the necessity for performing it has been greatly diminished by the introduction of a plan of treatment in which the knife is dispensed with: the passage of a flexible tube through the glottis into the trachea.

The causes which may render one of these operations necessary are numerous. Inflammatory swellings in the vicinity of the glottis, as in the tonsils, sometimes occasion great difficulty in breathing, and though I have never known tracheotomy performed in this place in consequence of an enlargement of the tonsils, yet it may possibly become necessary.—Tumours sometimes form in such situations as to impede respiration by pressing on the trachea.—Substances lodging in the œsophagus, by pressing forward the membranous part of the trachea and exciting spasm of the glottis, lessen the size of its cavity so as to cut off the free access of air to the lungs. —In some cases the tongue becomes so much swelled from the use of mercury as to fill up the mouth, and obstruct respiration. In most of the cases which have been enumerated, we may frequently avail ourselves of the introduction of a large elastic catheter into the trachea, and thereby avoid the necessity of tracheotomy.

The introduction of foreign substances into the glottis occasions always great uneasiness, violent coughing, and much irritation; hence it would appear from theory, a most imprudent act to force an instrument into this passage. Experience, however, proves that no danger results from it, and many cases have now occurred which establish the fact, that an elastic catheter may be left for many days in the trachea without exciting any other inconvenience than a convulsive cough at its first introduction. Even in cases where the irritability of the parts is augmented by inflammation, the introduction of a canula into the glottis is easily tolerated. The cough is at first violent, but it soon subsides and the patient breathes very well through the instrument.

When the tumour exists in the mouth, and the glottis is not diseased, the canula may be passed through the nostril, and readily finds its way into the windpipe.

In cases where foreign substances exist in the œsophagus pressing forward the membranous part of the trachea, nothing is easier than to pass a catheter into the glottis which will prevent the canal from being closed and allow the patient to respire freely. In these cases tracheotomy has often been performed—a surgeon once performed the operation to relieve from suffocation a young man, who for fear of being robbed, had swallowed his money, tied in a rag—it stopped in the pharynx, and would have killed him, had not tracheotomy been performed—now in this and similar cases, the operation recommended by Desault would certainly have prevented suffocation and afforded time to extract or force through the œsophagus into the stomach the substance arrested there.

The advantages of the plan are very considerable. The operation is not difficult;—there is no danger from bleeding vessels;—no wound to heal;—no risk of a fistulous opening;—consequences which sometimes follow the operation of tracheotomy.

A tube may with great safety be left a considerable time in the trachea; this fact is established by the case of a soldier in the hospital at Lyons, who cut his trachea through, and wounded the œsophagus. His surgeon introduced a large flexible catheter into the trachea, another into the œsophagus, by means of one he was nourished, and through the other he breathed during the cure. Although the operation of opening the trachea may *sometimes* be dispensed with and the introduction of a flexible tube substituted, yet this cannot always be done. Tracheotomy becomes necessary in certain cases when foreign bodies are lodged in the trachea and cannot be coughed up. Writers also mention polypi and other excrescences in the trachea, as causes demanding the operation; these are, however, very rare.

Foreign substances having entered the glottis sometimes get fixed in the ventricles of the larynx, this accident has often happened, they produce less disturbance here than in the trachea or glottis, sometimes remaining many years without occasioning any unpleasant effects; they must of necessity be very small. If the foreign body should rest in the glottis so as to impede respiration, no time is to be lost, an opening must be made below it, and the substance pushed up with a probe.

When any substance falls into the windpipe, it occasions violent coughing and difficulty of breathing, attended with the usual symptoms of suffocation; but if the foreign body be not discharged by the efforts of coughing, and death be not occasioned by the obstruction to respiration, then we are to infer that the substance has passed through the glottis into the trachea, the irritation in this case is greatly diminished and after a short time entirely subsides. Heister relates several instances in which foreign bodies have passed down to the bifurcation of the trachea, and there remained for many years.

In consequence of the facility with which the membranous partition between the œsophagus and trachea may be pushed forward, so as to diminish the cavity of the latter canal, and of the spasmodic action of the muscle of the glottis excited by any irritation of these parts, it is occasionally difficult to ascertain, whether the foreign substance be actually in the œsophagus, or trachea. Indeed mistakes have been made, and the trachea has been laid open in cases where nothing has been found in it, the obstruction having proceeded from pressure in the œsophagus. It is of the utmost importance before proceeding to such an operation to ascertain precisely whether the body be in the œsophagus or not, and this can readily be done by passing a probang or catheter down the œsophagus, which will remove all doubt.

When the catheter is to be introduced, it should be one of the largest size in use for the urethra. It is to be held as a pen, and passed through the mouth, or if this be inconvenient from the nature of the disease, through the nostril, at the fauces it readily passes either into the larynx or pharynx; at the former it produces, *First,* A cough and tickling pain, with desire to vomit, and a spasmodic elevation of the larynx. *Secondly,* The flame of a candle placed before the end of it is blown to one side. *Thirdly,* In passing it still further, resistance is felt at the bronchiæ. In the pharynx and œsophagus there is less irritation—no cough—no blast of air—but if some fluid is injected through the tube, the doubt ceases: if it pass into the larynx, violent coughing is occasioned, and it returns; if on the contrary into the œsophagus, no inconvenience results.

When any difficulty is found in passing the tube into the glottis, a stilette may be introduced into it properly curved; by this means it acquires sufficient firmness to be passed through the glottis. When introduced it is to be secured to the patient's night cap, and a piece of gauze must be fastened over the orifice of the tube in order to prevent the dust and floating matter of the air, from being drawn into the lungs. The tube is to be often removed and cleansed, as the apertures at its extremity are soon filled with mucus so as to obstruct the free passage of air.

When the operation of bronchotomy becomes necessary there are two places of performing it, one at the lower part of the larynx, the other in the trachea. Tracheotomy consists in making a puncture between the rings of the windpipe, or if necessary for the extraction of foreign matters it may be divided longitudinally, for a considerable length. But of late the French surgeons have preferred very much the division of the larynx, and they state the following advantages which this operation possesses.

In dividing the membrane between the cricoid and thyroid cartilages the skin and a very small portion of cellular membrane are the only substances met with. While in tracheotomy, the skin, much cellular substance, and generally a part of the thyroid gland, are divided.

There is never any hemorrhage from the puncture between the cricoid and thyroid cartilages, whereas the other operation is almost always followed by more or less hemorrhage, and this is an important circumstance, because it occasions delay, or, by falling into the trachea, produces unpleasant effects. Desault relates an instance of a child who died from loss of blood before the operation could be completed. The larynx is firmly supported, and the operation is easily performed; in the trachea, so much motion is allowed that it is often pushed before the knife, and in one case the carotid artery was opened owing to this circumstance; laryngotomy is therefore upon the whole to be preferred.

OPERATION.

The patient is to be seated, and the head inclined somewhat backwards, a bistoury and a curved canula adapted to the larynx are to be provided. The surgeon placed before the patient searches for the space between the thyroid and cricoid cartilages, and makes an incision with the bistoury an inch long, through the skin and cellular membrane, from the bottom of the thyroid to the cricoid cartilage—the edges of this wound being separated, the bistoury is to be passed through the membrane of the trachea, low down, so as to avoid a small artery sometimes found on the lower edge of the thyroid cartilage. If this be divided however, it is to be taken up immediately. The canula is next introduced and secured by tapes, the angles of the wound covered with lint, and the end of the canula with gauze.

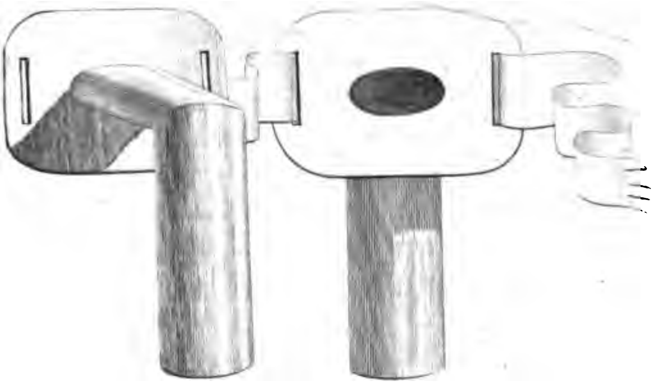
When a foreign substance is to be extracted, the aperture may be enlarged, by means of a pair of forceps and a bistoury; the forceps when introduced into the wound may be opened so as to stretch the trachea and liberate the substance, which may then be extracted, or pushed upwards through the glottis. The cricoid cartilage, if necessary, may be cut through in this operation, and a considerable portion of the thyroid may be divided.

Where the object has been to remove a foreign substance, the wound may be immediately closed, and in general it soon unites, but it is sometimes necessary to leave the canula in the wound, and then great attention must be paid to frequently cleansing it, because the collection of mucus is so great as to impede the passage of air when this caution is neglected.

I have sometimes found it necessary to introduce a canula into the trachea, in cases where it has been opened by persons attempting to destroy themselves. In these cases it is difficult to prevent the collection of blood and mucus in the cavity of the canula, and great care is necessary to change the tube frequently, in order to remove the obstructions which may be formed within it.

PLATE XV.

Canula for Laryngotomy



CHAPTER LXX.

Accidents and Diseases of the Ear.

THE MEATUS AUDITORIUS EXTERNUS is frequently plugged up in children with foreign substances, as corn, beads, &c., and in adults with hardened wax. In these cases a common eyed probe bent so as to form a hook at the perforated extremity, is a very convenient instrument for extracting them. The wax if necessary may be softened by injections of warm water. In general the hearing is immediately restored when the passage is cleared.

Insects sometimes crawl into the ear and excite extreme pain;—a little olive oil poured into the external meatus kills them very speedily, and they can be readily extracted. Worms have occasionally been found in this canal, their ova having been previously deposited, probably during sleep; an infusion of tobacco in these cases may be poured into the meatus; it does not irritate the parts, and is fatal to the insects.

Abscesses sometimes form in the vicinity of this canal and discharge themselves into it—when this is the case, the hearing is generally unimpaired. Should the tympanum, however, be affected, the bones of the ear are sometimes discharged through the membrana tympani and hearing is greatly injured or entirely destroyed. When the symptoms of inflammation exist in this important organ, the usual remedies for it are to be employed, with a view to prevent the formation of pus;—a number of leeches behind the ear, and blisters afterwards are to be applied. Mr. Saunders observes that when these remedies are unsuccessful and matter has formed, it is generally evacuated, as far as he has observed, between the auricle and mastoid process, or into the meatus. If it has been evacuated into the meatus, the opening is most commonly small, and the spongy granulations, squeezed through a small aperture, assume the appearance of a polypus. Sometimes the small aperture, by which the matter is evacuated, is in this manner even closed, and the patient suffers the inconvenience of frequent returns of pain from the retention of the discharge. When the parts have fallen into this state, it will be expedient to hasten the cure by making an incision into the sinus, between the auricle and mastoid process.

It occasionally happens that the bone itself dies, in consequence of the sinus being neglected, or the original extent of the suppuration. The exfoliating parts are the meatus externus of the os temporis or the external lamina of the mastoid process.

When polypi are found in the external meatus they are to be removed by the knife or forceps.

The CAVITY OF THE TYMPANUM is sometimes, as has been remarked, the seat of abscess; in these cases the membrane is destroyed, and air passes through the ear when the patient closes his mouth and blows forcibly; these abscesses are sometimes the result of common inflammation, and sometimes follow small-pox and other diseases. The usual remedies for inflammation are the only means of preventing suppuration, and where pus is evidently formed, notwithstanding their exhibition, Mr. Saunders advises a puncture to be made through the membrana tympani, in preference to allowing the abscess to burst. When the discharge of pus continues a great length of time, astringent injections of white vitriol and sugar of lead dissolved in water, may be used. Blisters and setons applied behind the ear are also advantageous.

The EUSTACHIAN TUBE is sometimes obstructed and occasions a considerable degree of deafness. A severe catarrh frequently produces a temporary deafness of this kind. When this tube is obstructed the patient is unable to inflate the tympanum as in health; the sensation attending this inflation is more easily felt than described; to produce it, is only necessary to make a forcible attempt at expiration while the nostrils and mouth are closed. Mr. Astley Cooper has proposed when permanent obstructions exists in the Eustachian tube, to perforate the membrane of the tympanum, an operation which has been repeatedly performed, and sometimes with success. I have tried it but without any benefit, though I should have no hesitation in repeating it, because it can do no harm to a deaf person and has in many cases proved beneficial—a couching needle or sharp pointed probe answers the purpose very well—when inserted through the membrana tympani a sharp pain is felt, but it quickly subsides. The instrument should not be pushed so far as to wound the parts within the membrane. Air in this manner will be admitted to the cavity of the tympanum, and if deafness should have arisen from a want of it, it will be relieved. Mr. Saunders in one case by this operation instantaneously relieved a deafness of thirty years standing—he recommends a large aperture to be made, a small one being apt to close up.

DISEASES OF THE LABYRINTH are very generally beyond the reach of surgery. In some cases the parts upon dissection evince no morbid alteration, and the want of sensation has probably been owing to the state of the nerve. In other cases the labyrinth is found filled with a cheesy concretion, instead of the natural fluid which should be found.

Mr. Saunders considers most of the diseases of the internal ear as depending on the nerve of hearing, the portio mollis of the auditory nerve being probably paralytic. Various noises are generally perceived by patients labouring under deafness from the palsy of the nerve, such as the murmuring of water, the hissing of a boiling kettle, &c.

The remedies which have oftenest been useful (and they have been but very rarely so) are long continued purging, low diet, and the use of mercury, with blisters, issues, and setons applied in the vicinity of the ear.

Mr. Saunders has known a nervous deafness, originating from a syphilitic source, to be relieved completely by a mercurial course. Deafness, however, is a very rare consequence of the venereal disease, unless when it arises from ulcers, or scabs, in the external meatus, in which case it is temporary, and amounts merely to an external obstruction readily removable.

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